EclipseUML by examples

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Laboratorio di Sistemi e Processi Organizzativi

Module Road Map

- How to Install
- Class Diagram Example
- The Game of Life

Module Road Map

- **Overview and how to install**
- Class Diagram Example
- The Game of Life

What is Omondo EclipseUML?

- Omondo EclipseUML is a visual modeling tool
  - natively integrated with Eclipse
  - http://www.eclipseuml.com
  - one of the most successful Eclipse plug-ins with more than 250,000 downloads in the last 12 months
  - the leading UML Eclipse plugin
- Omondo offers two different tools:
  - EclipseUML Free Edition
    - which is a UML specialized tool;
  - EclipseUML Enterprise Edition
    - which provides data modeling, UML, J2ee, and business process modeling,
    - time limited trial

How to install Eclipse

- http://www.eclipseuml.com/download/free/index.jsp
  - download Eclipse 2.1.1 in accordance with your OS
    - eclipse-SDK-2.1.1-win32.zip or
    - eclipse-SDK-2.1.1-linux-gtk.zip
  - download EclipseUML latest version
    - eclipseuml-installer_1.2.1.20031103.jar
- according to your OS, unzip eclipse-SDK into
    - C:\eclipse
    - \usr\local\eclipse
- run
    - java -jar eclipseuml-installer_1.2.1.20031103.jar
    - specifying the right installation directory

Module Road Map

- Overview and how to install
- **Class Diagram Example**
- The Game of Life

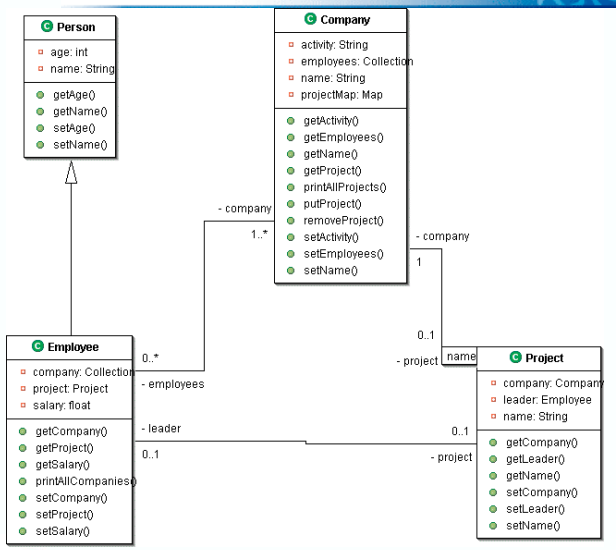
Class Diagram Example

- The following path from the eclipse directory

  eclipse\plugins\com.omondo.uml.doc.user_1.2.1\doc\diagrams\classDiagram\ClassDiagramExample\ClassDiagramExample.html

  shows a class diagram creation.
- This is a good point to start.

Class Diagram Example



Module Road Map

- Overview and how to install
- Class Diagram Example
- **The Game of Life**

References

The following slides are extracted from a courseware which is part of the Open Source "ECESIS" project

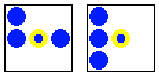
- The courseware is produced by, and is copyrighted by Espirity, Inc. and CMA
- To get the whole course material go to
  - http://www.eclipse.org/ecesis/

Rules of the Game of Life

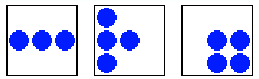
- Life is played on a grid of square cells (like a chess board) but extending infinitely in every direction.
- A cell can be ***live*** or ***dead***.
  - A live cell is shown by putting a marker on its square.
  - A dead cell is shown by leaving the square empty.
- Each cell in the grid has a neighborhood consisting of the eight cells in every direction including diagonals.
- To apply one step of the rules, we count the number of live neighbors for each cell. What happens next depends on this number.

Rules of the Game of Life

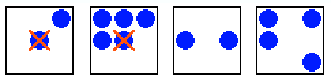
- A dead cell with exactly three live neighbors becomes a live cell (birth).



- A live cell with two or three live neighbors stays alive (survival).

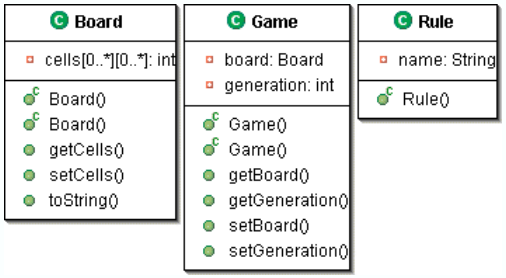


- In all other cases, a cell dies or remains dead (death).



What objects can we identify?

- The basic classes in the system may be
  - Board
  - Game
  - Rule
- Create 3 classes



Board.java

- Edit Board.java *constructors* and *toString*:

```
public Board() {
  this.cells = new int[10][10];
}
public Board(int[][] cells) {
  this.cells = cells;
}
public String toString() {
  return "Board for game of life";
}
```


Game.java and Rule.java

- Edit Game.java *construtors*

```
public Game(Board aBoard) {
  this.board = aBoard;
  this.generation = 1;
}
public Game() {
  setBoard(new Board());
}
```

- Edit Rule.java *construtor*

```
public Rule(String name) {
  this.name = name;
}
```


Use scrapbook pages

- Inspect with scrapbook the following code:

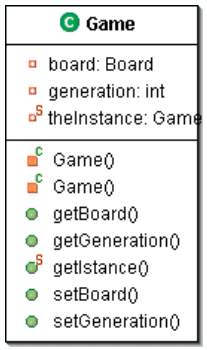
```
int[][] boardCells = {
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1}};
Board board = new Board(boardCells);
Game game = new Game(board);
game
```

Singleton pattern

- How many instances of the Game class will we need at the same time in one single application?
  - Just one.
- Define a private static field called theInstance in the Game class.
- Lazy initialization:

```
public static Game getIstance() {
  if(theInstance == null)
        theInstance = new Game();

  return theInstance;
}
```



Edit toString

- Edit toString method in Board class:

```
public String toString(){
  StringBuffer buffer = new StringBuffer();
  for (int i = 0; i < getCells().length; i++){
        buffer.append("\n");
        for (int j = 0; j < getCells()[0].length; j++){
              if (getCells()[i][j] == 0)
                    buffer.append("0");
              else
                    buffer.append("1");
              }
  }
  return buffer.toString();
}
```

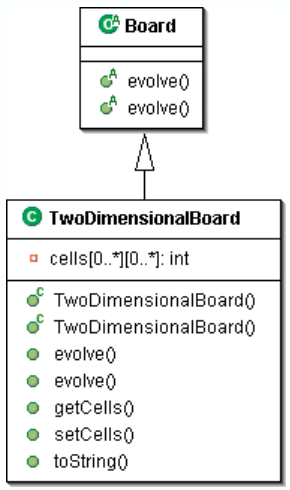

Use scrapbook pages

- Execute with scrapbook the following code:

```
int[][] boardCells = {
{0, 0, 0, 1, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 1, 0, 0, 0 , 0, 0, 1},
{0, 0, 1, 1, 1, 0, 0 , 0, 0, 1},
{0, 0, 1, 1, 1, 0, 0 , 0, 0, 1},
{0, 0, 1, 1, 1, 0, 0 , 0, 0, 1},
{0, 0, 0, 1, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 0, 0, 0, 0 , 0, 0, 1},
{0, 0, 0, 1, 0, 0, 0 , 0, 0, 1},
{0, 0, 1, 1, 1, 0, 0 , 0, 0, 1},
{0, 0, 1, 1, 1, 0, 0 , 0, 0, 1}};
Board board = new Board(boardCells);
System.out.println(board)
```

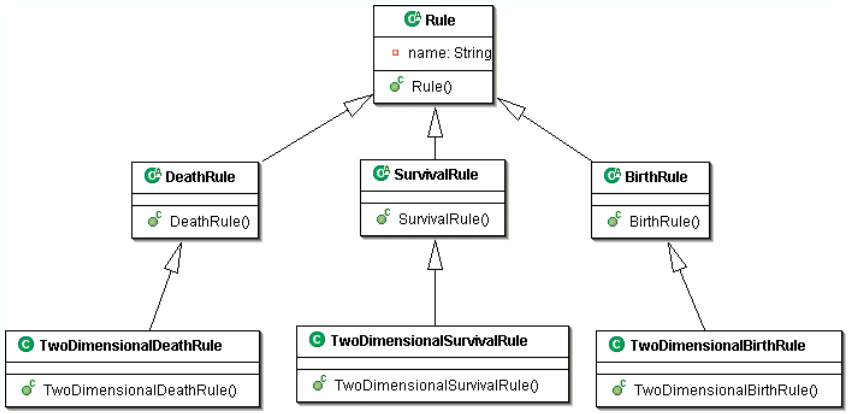

Board class Refactoring

- Change the `Board` class name to `TwoDimensionalBoard`
  - Refactor->Rename
- Create an abstract class `Board` with abstract `evolve` methods
  - **`public abstract void`** `evolve(Game);`
  - **`public abstract void`** `evolve(Game, int);`



Rule class Refactoring

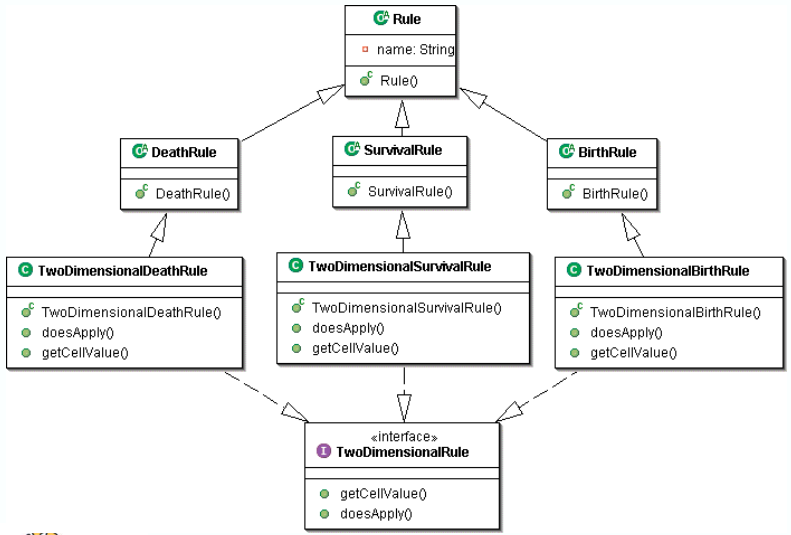
- Change the `Rule` class definition to `abstract`
- Create the following classes:



Create Interface

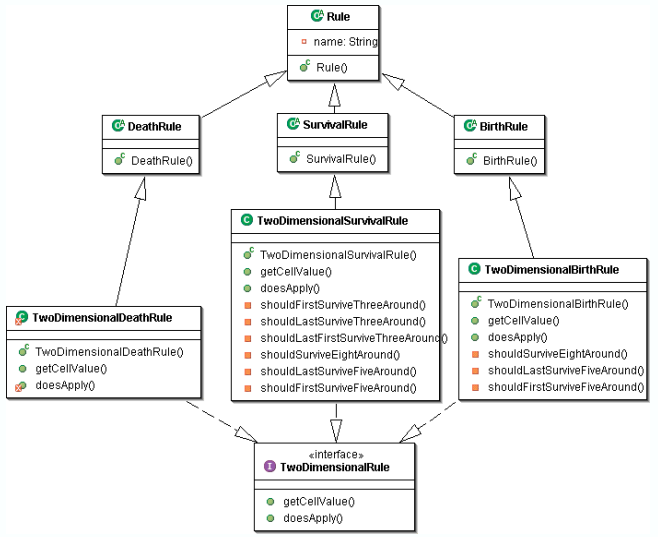
- Create new interface `TwoDimensionalRule` with two methods:
  - doesApply()
  - getCellValue()
    - it should simply return int value,
    - for birth and survival rules it would be 1,
    - for death rule it would be 0.

Create Interface



Import rules

- Import the 3 provided rule classes.



Redesign the Game class

- Make the `Game` class previously defined `abstract`.
- Create `TwoDimensionalGame` class that inherits from `Game` class.
- Default constructor in the `Game` class should initialize rules:

```
public Game() {
  this.rules = new Rule[3];
  this.generation = 1;
}
```

- Move singleton implementation to `TwoDimensionalGame` and let the following be the constructor of the class:

```
private TwoDimensionalGame(){
  setBoard(new TwoDimensionalBoard());
  getRules()[0] = new TwoDimensionalBirthRule("Birth Rule");
  getRules()[1] = new TwoDimensionalSurvivalRule("Survivel Rule");
  getRules()[2] = new TwoDimensionalDeathRule("Death Rule");
}
```


The evolve method

- Implement `evolve` method in the `TwoDimensionalBoard` class.

```
public void evolve(Game aGame) {
   boolean doesAnyApply = false;
   TwoDimensionalRule rule = null;
   for (int i = 0; i < cells.length; i++){
        for (int j = 0; j < cells[0].length; j++){
                doesAnyApply = false;
                for (int k = 0; k < aGame.getRules().length; k++){
                rule = (TwoDimensionalRule)aGame.getRules()[k];
                  if(rule.doesApply(getCells(), i, j)){
                        getCells()[i][j] = rule.getCellValue();
                        doesAnyApply = true;
                        break;
                  }
                }
        if (!(doesAnyApply))
          System.out.println("No rules apply for cell[" + i + "][" + j + "]");
        }
   }
}
```


Evolve and run methods

- Implement a second `evolve` method which evolves board as many times as passed `index`:

```
public void evolve(Game aGame, int index){
  if (index == 0) return;
  for (int i = 1; i <= index; i++){
        evolve(aGame);
        System.out.println(this);
  }
}
```

- Implement run method in the `Game` class:

```
public void run(){
  getBoard().evolve(this, getGeneration());
}
```


Test the game

- Create a new package and a new class with main method lioke the following:

```
public static void main(String[] args) {
     int[][] boardCells = {
     {0, 0, 0, 1, 0, 0, 1 , 0, 1, 0},
     {0, 0, 1, 0, 1, 0, 1 , 0, 0, 0},
     {1, 0, 0, 1, 0, 0, 1 , 0, 0, 0},
     {0, 0, 0, 1, 0, 0, 1 , 0, 0, 0},
     {0, 0, 1, 0, 1, 0, 1 , 1 ,0, 0},
     {0, 0, 0, 1, 0, 0, 1 , 1, 1, 0},
     {0, 0, 0, 1, 0, 0, 1 , 1, 0, 1},
     {1, 0, 1, 0, 1, 0, 1 , 0, 1, 0},
     {0, 0, 1, 0, 1, 0, 1 , 0, 1, 1},
     {0, 0, 0, 1, 0, 0, 1 , 0, 0, 1}};
     TwoDimensionalBoard board = new TwoDimensionalBoard(boardCells);
     TwoDimensionalGame game = TwoDimensionalGame.getInstance();
     game.setBoard(board);
     game.setGeneration(10);
     game.run();
}
```