Case study

Case study

- Problem
  - A very simple problem to show the use of UML in analysis and design
  - It is taken from the “Applying UML and Patterns” book of Claig Larman
  - A dice game
    - They player rolls 10 times 2 dice. If the total of two dice is 7, he gains 10 points. At the end of the game, the score is saved to the scoreboard

Main Activities of Software Development

Requirements Gathering

Define requirement specification

Analysis

Define the conceptual model

Design

Design the solution / software plan

Implementation

Code the system based on the design

Integration and Test

Prove that the system meets the requirements

Deployment

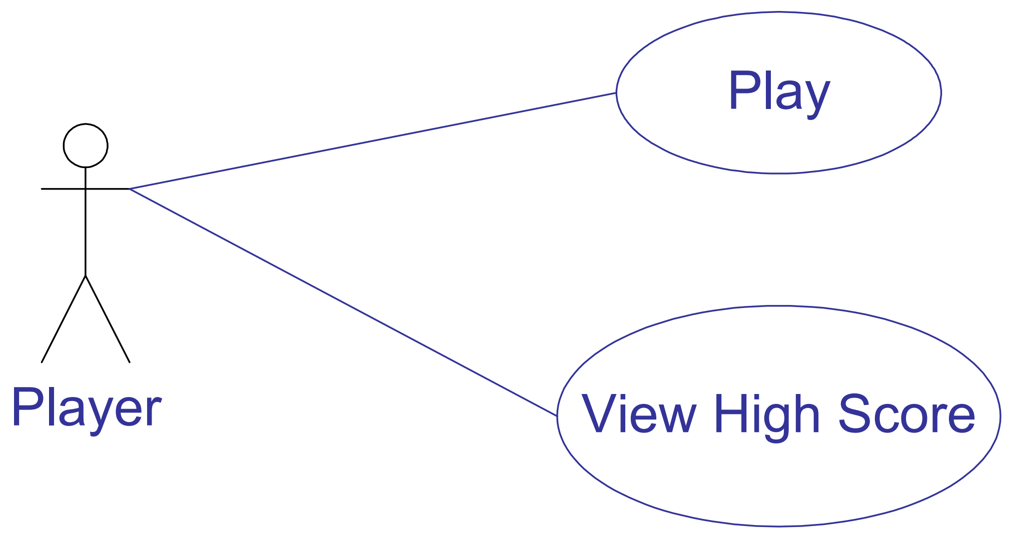
Installation and training

Maintenance

Post-install review
Support docs
Active support

Case study

- Requirement analysis
  - Use-case diagram

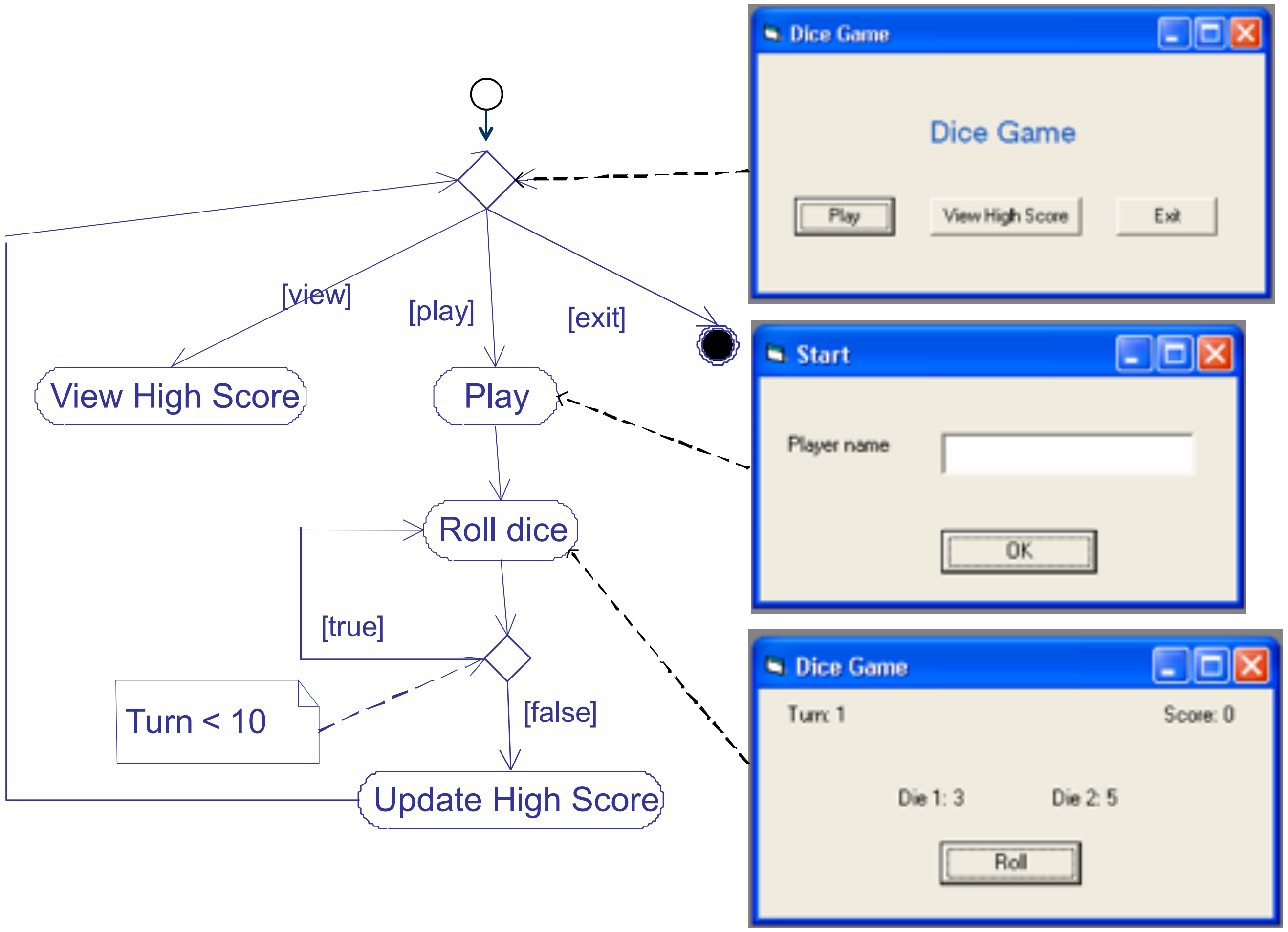


  - Use-case: Play
    - Description: The player rolls 2 dice 10 times. If each time the total is 7, he receives 10 points.

  - Use-case: View High Score
    - Description: They player consults the scores

Case study

- Requirement analysis
  - Activity diagram
    - Some activities are linked to the graphical user interface



Dice Game

Player name

Turn: 1

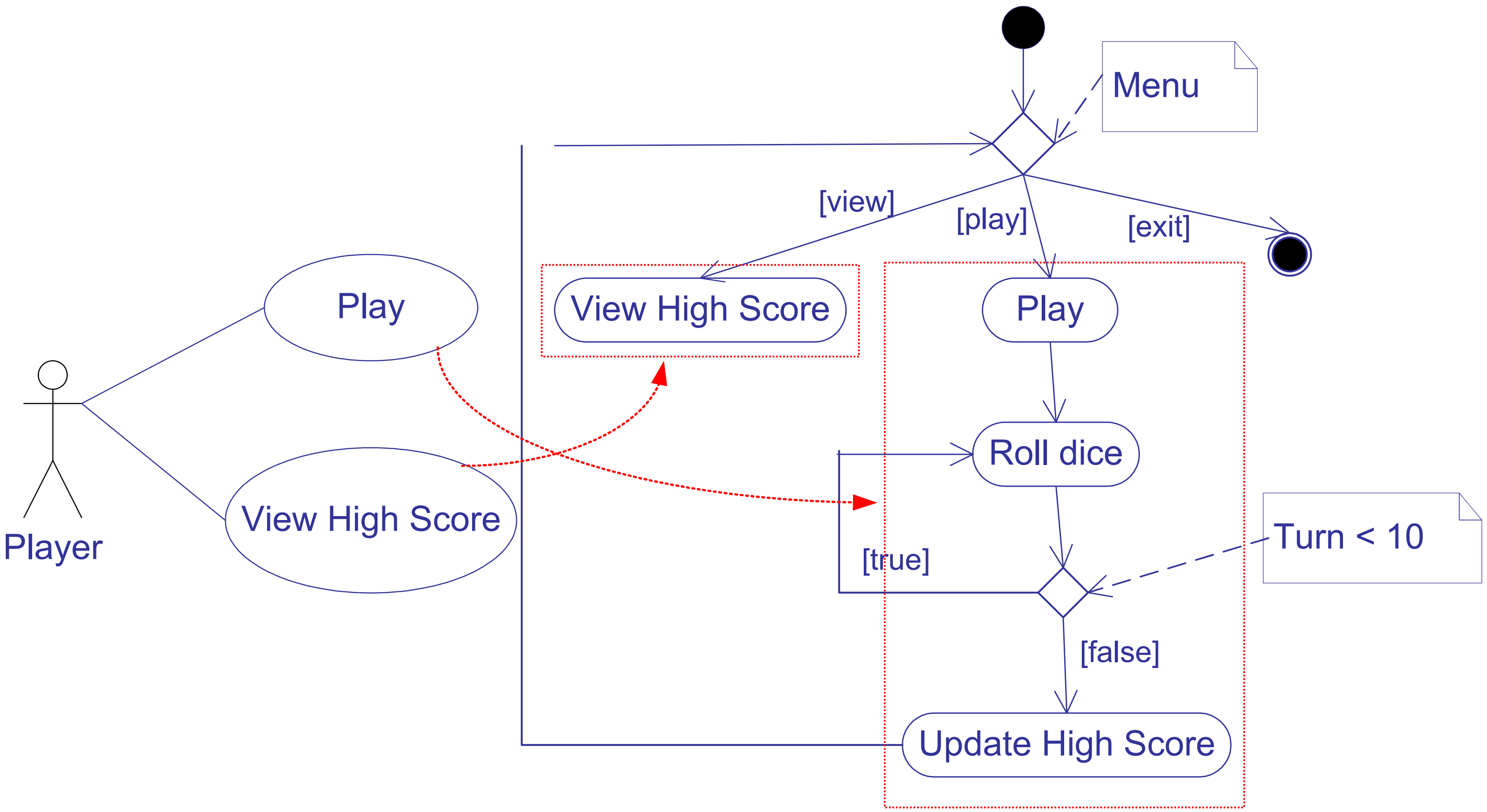
Score: 0

Die 1: 3

Die 2: 5

Use-case

- Requirement analysis
  - Activity diagram
    - The relationship between the use-case diagram and activity diagram



Main Activities of Software Development

Requirements Gathering

Define requirement specification

Analysis

Define the conceptual model

Design

Design the solution / software plan

Implementation

Code the system based on the design

Integration and Test

Prove that the system meets the requirements

Deployment

Installation and training

Maintenance

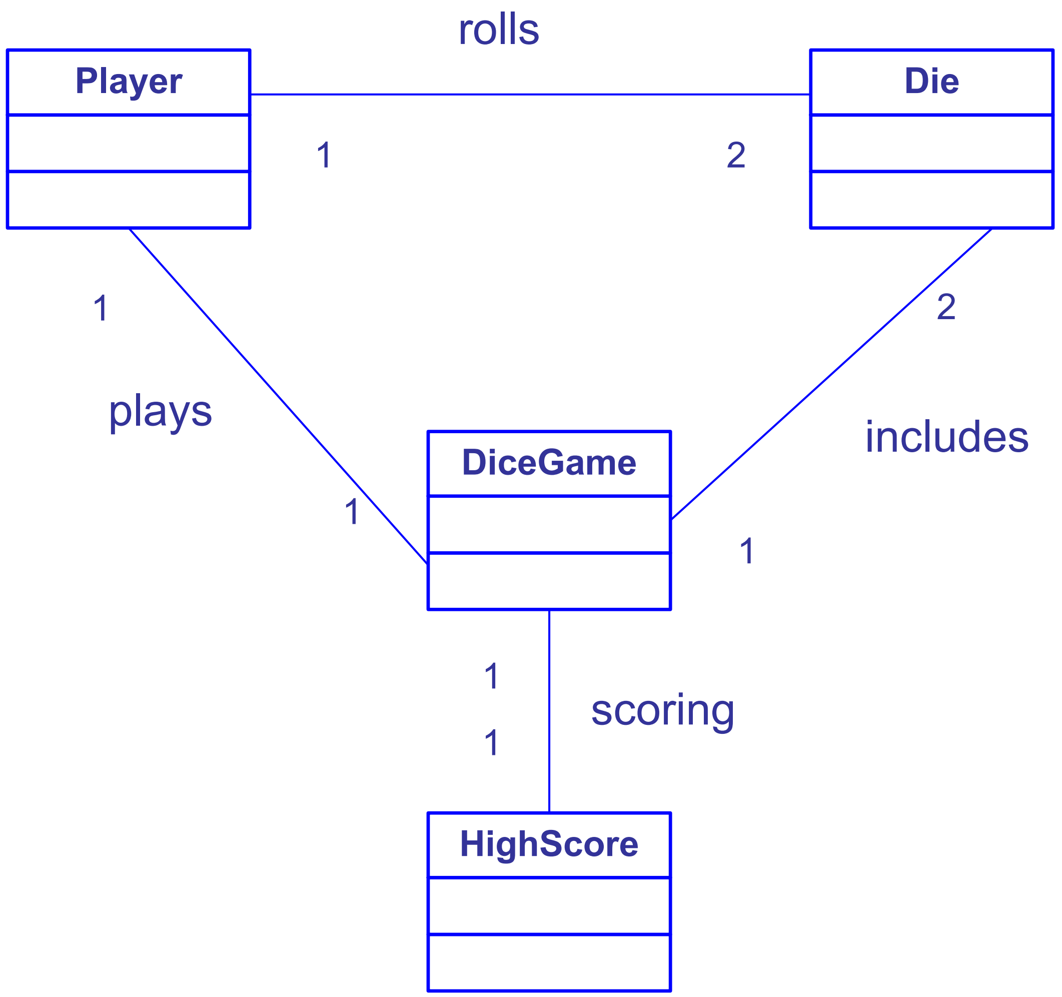
Post-install review
Support docs
Active support

Case study

- Analysis
  - Modelling the real world
  - Independent of the implementation
  - Modelling of the domain: conceptual class diagram
  - Modelling of the dynamic behaviour of the system: collaboration diagram

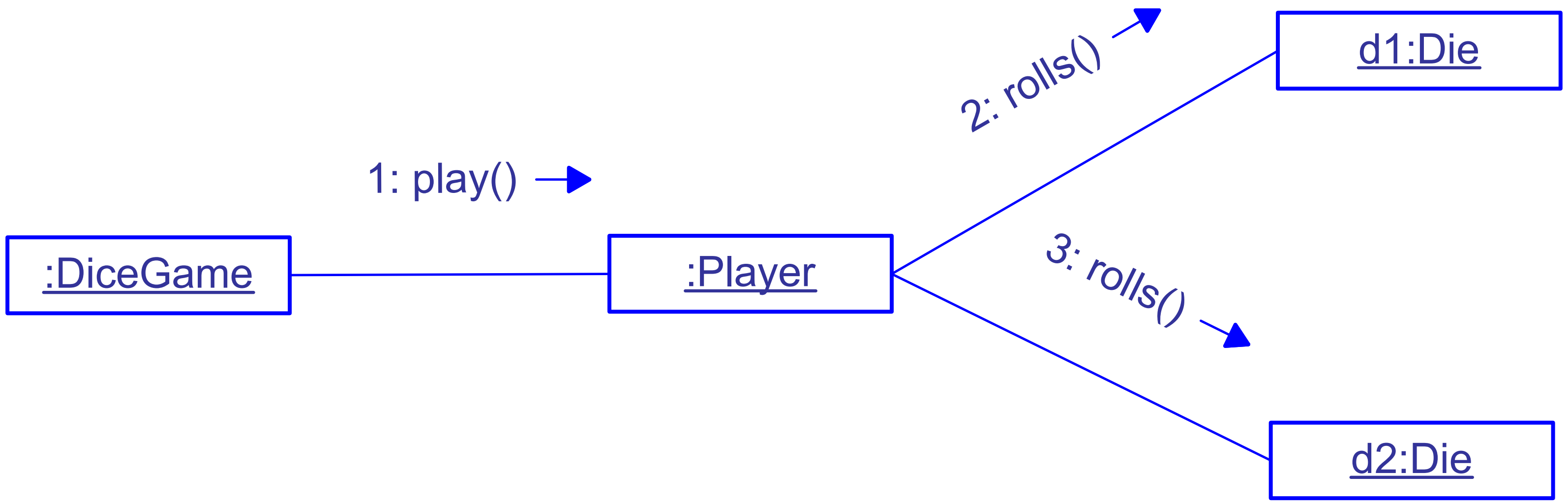
Case study

- Modeling of conceptual class diagram



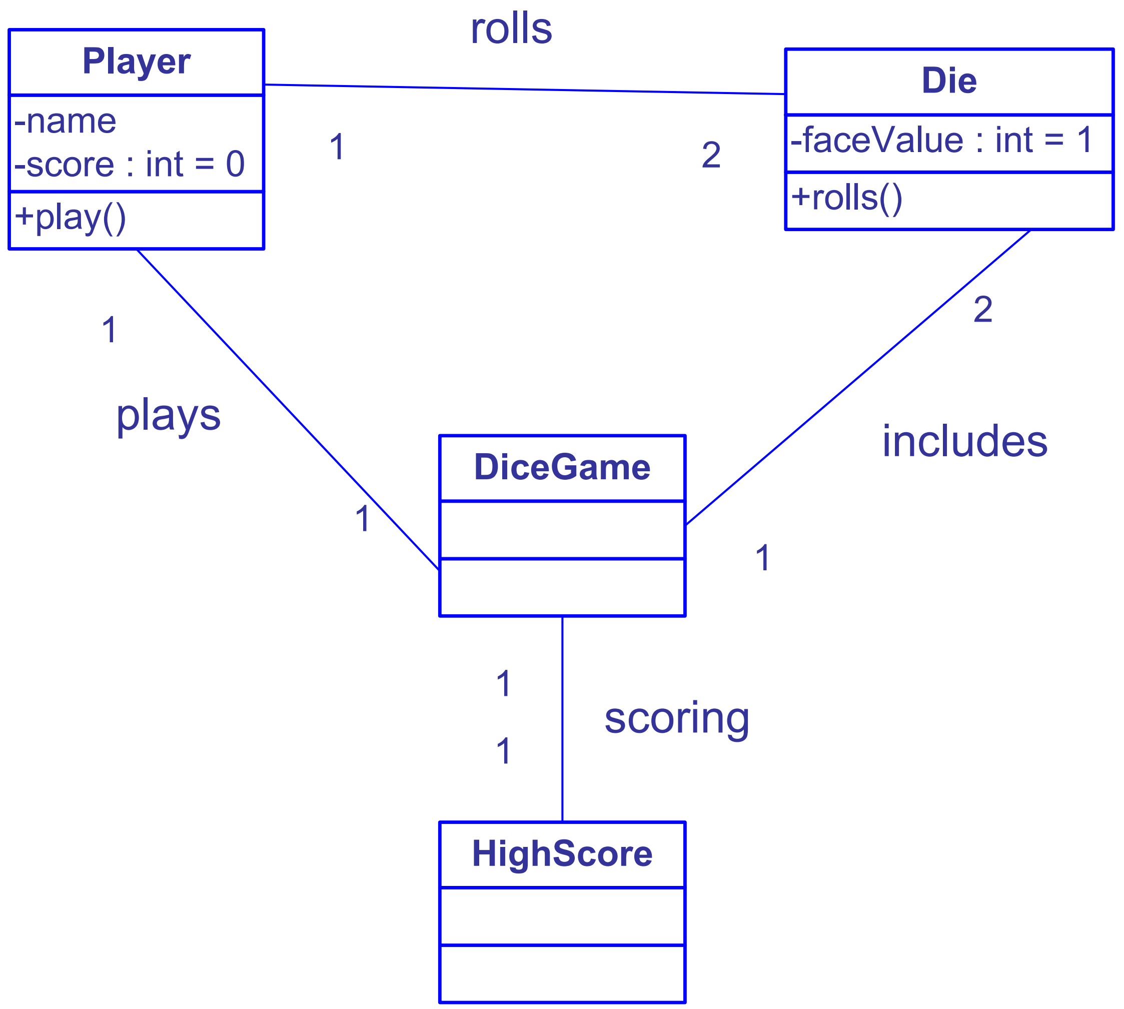
Case study

- A first collaboration diagram



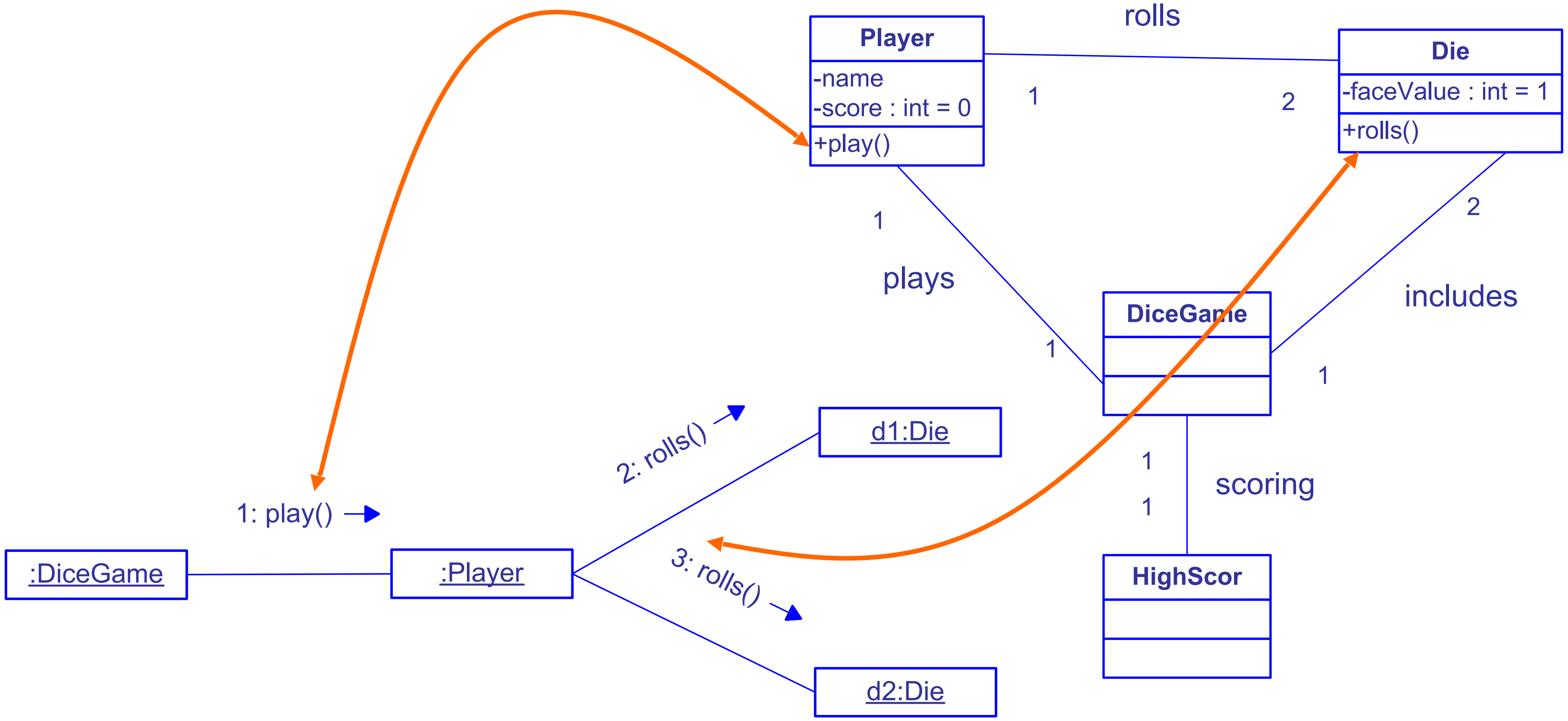
Case study

- A first class diagram



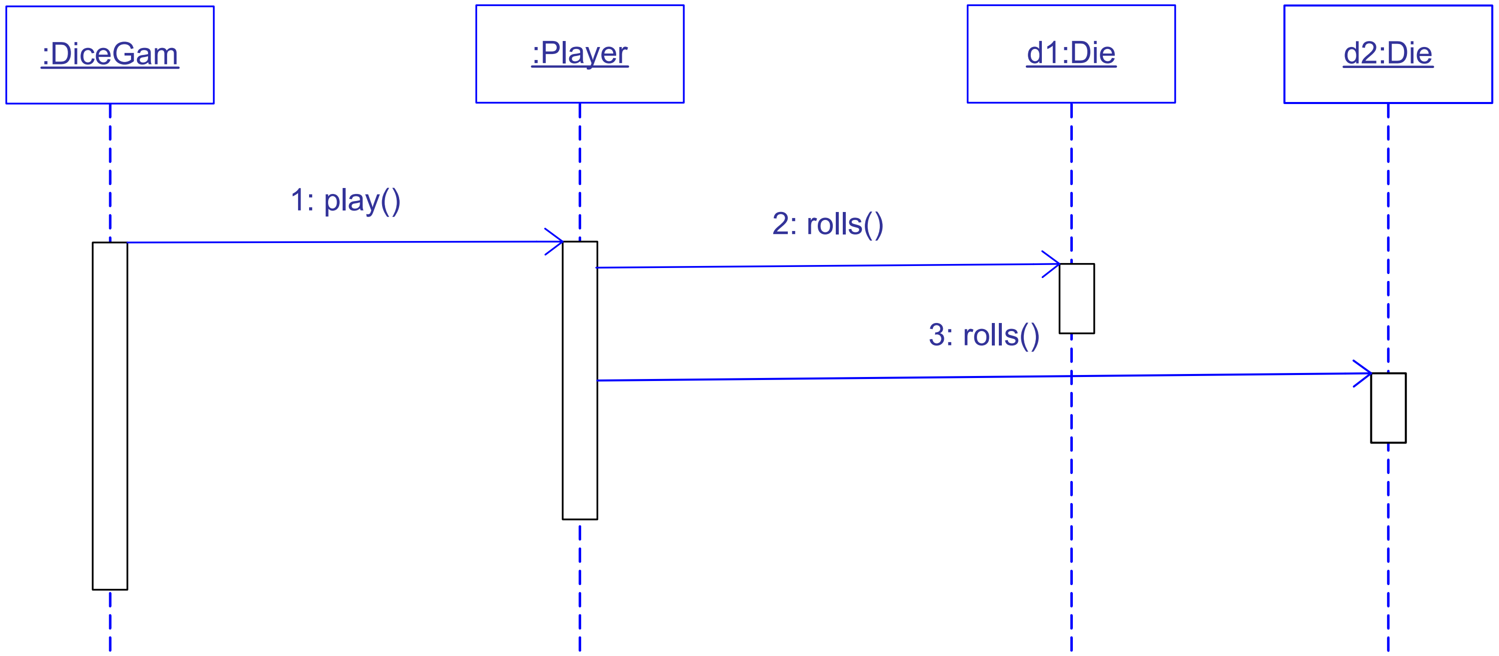
Case study

- Collaboration diagram and class diagram



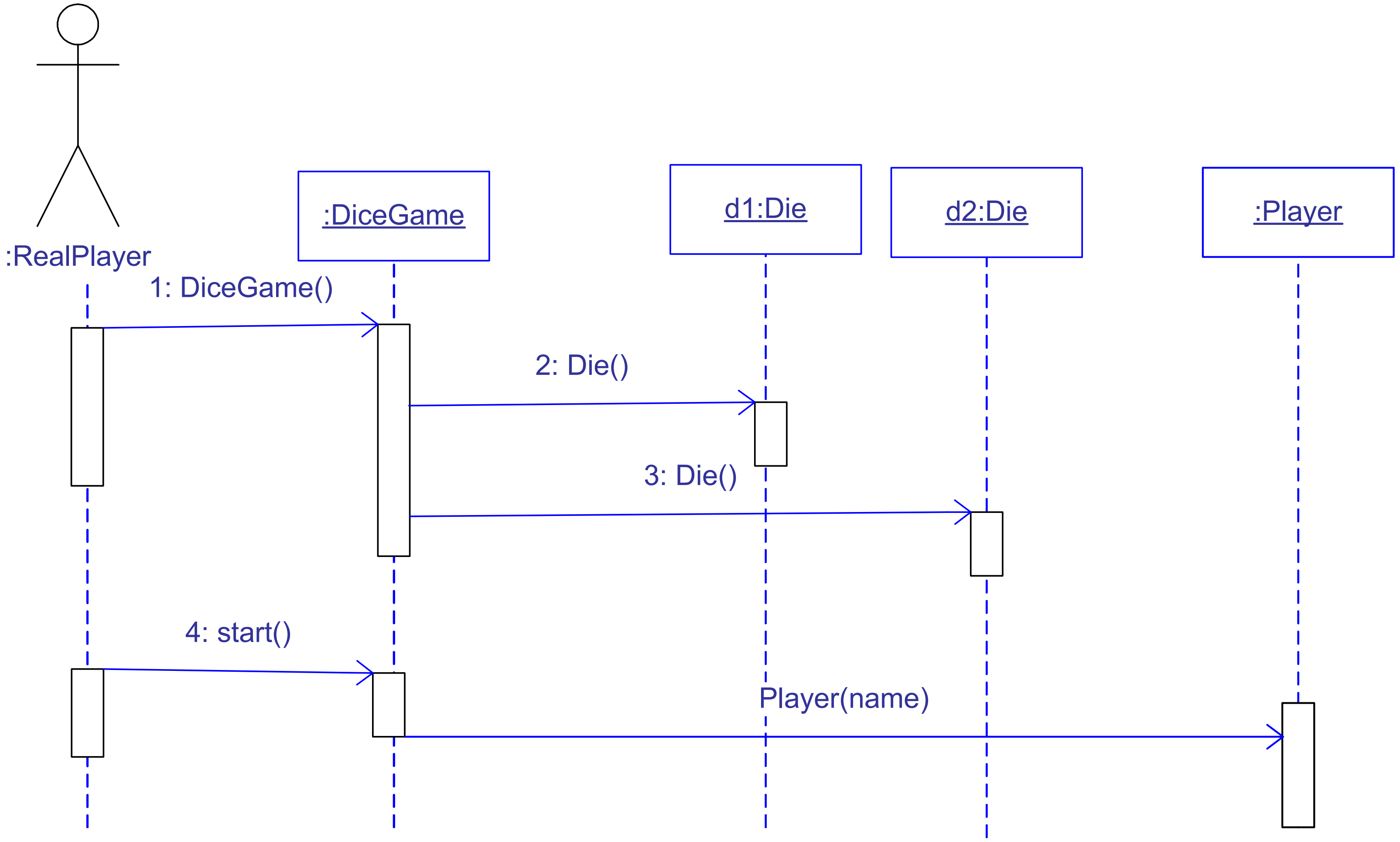
Case study

- Sequence diagram



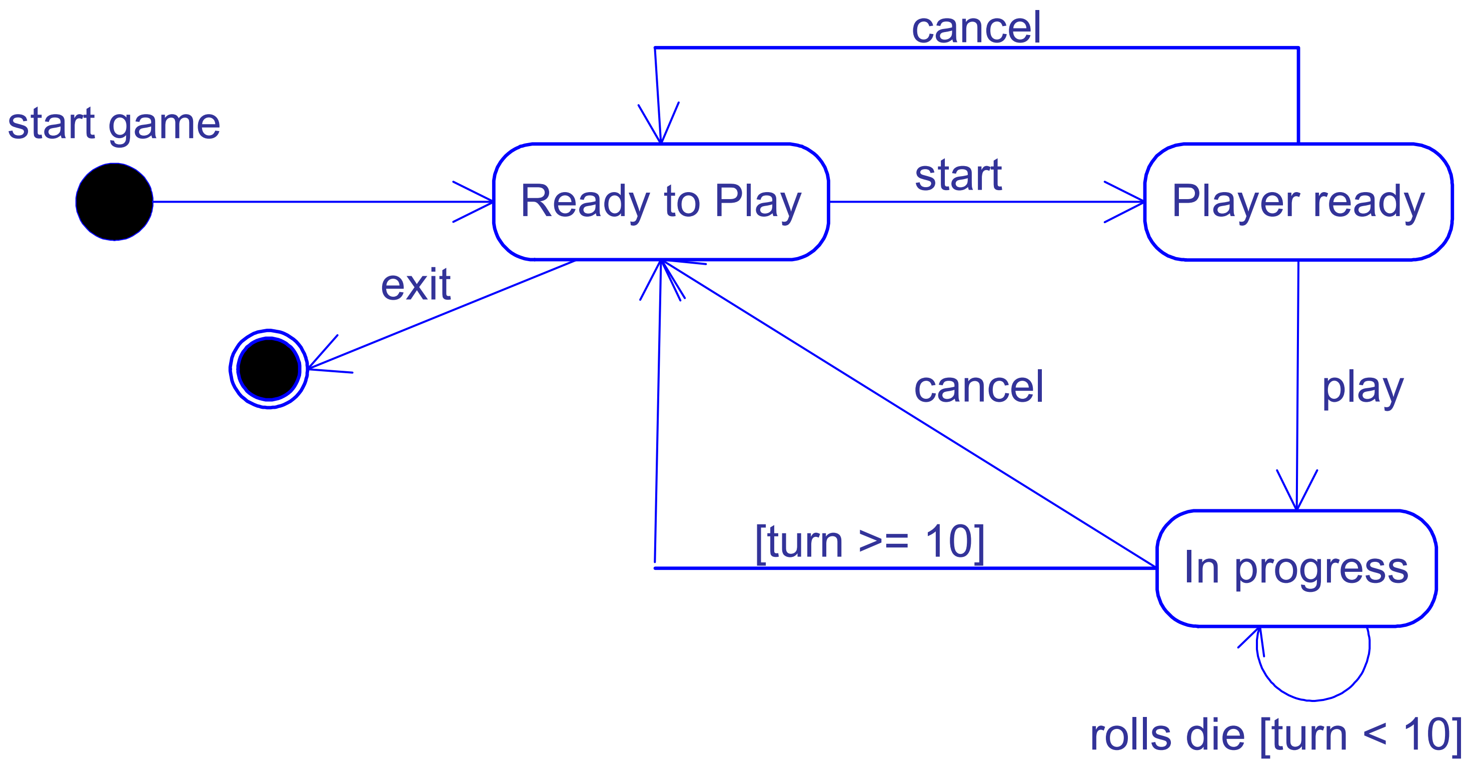
Case study

- The creation of objects at the beginning of the game (DiceGame) for a player



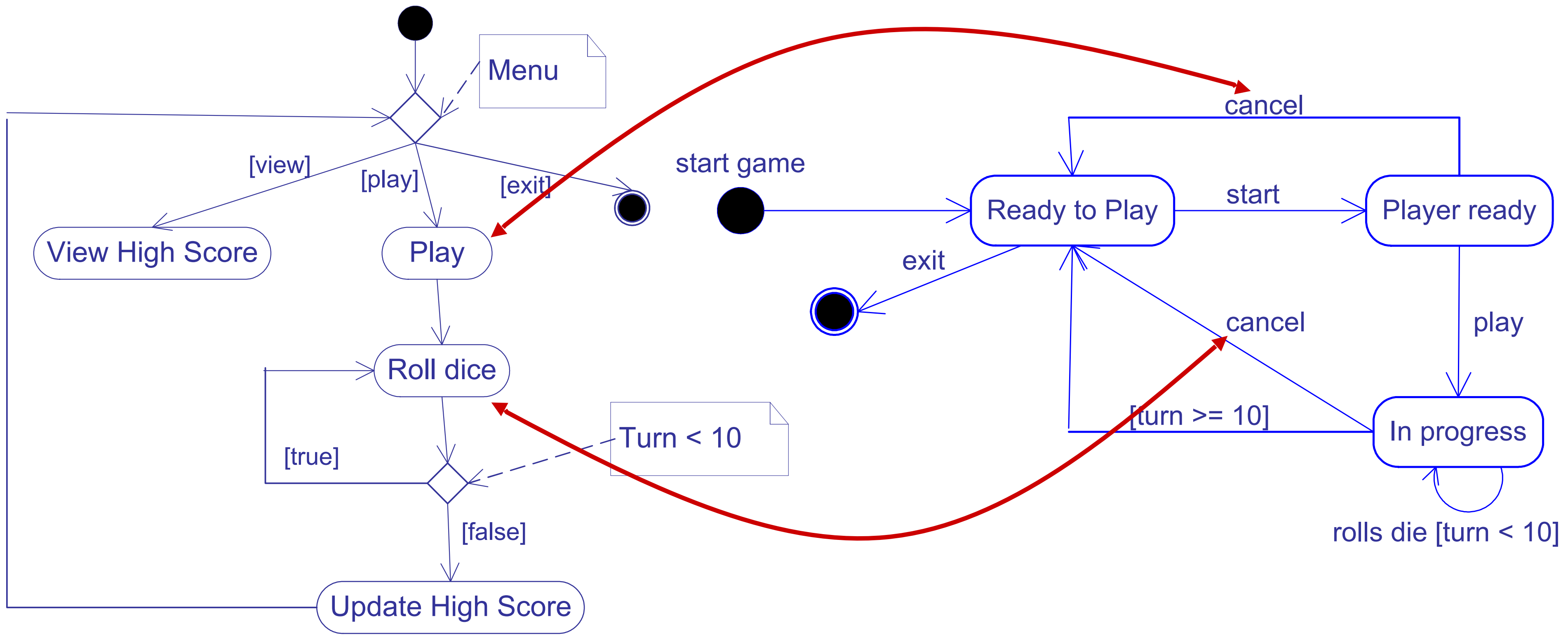
Case study

- State diagram: modelling the states of the DiceGame



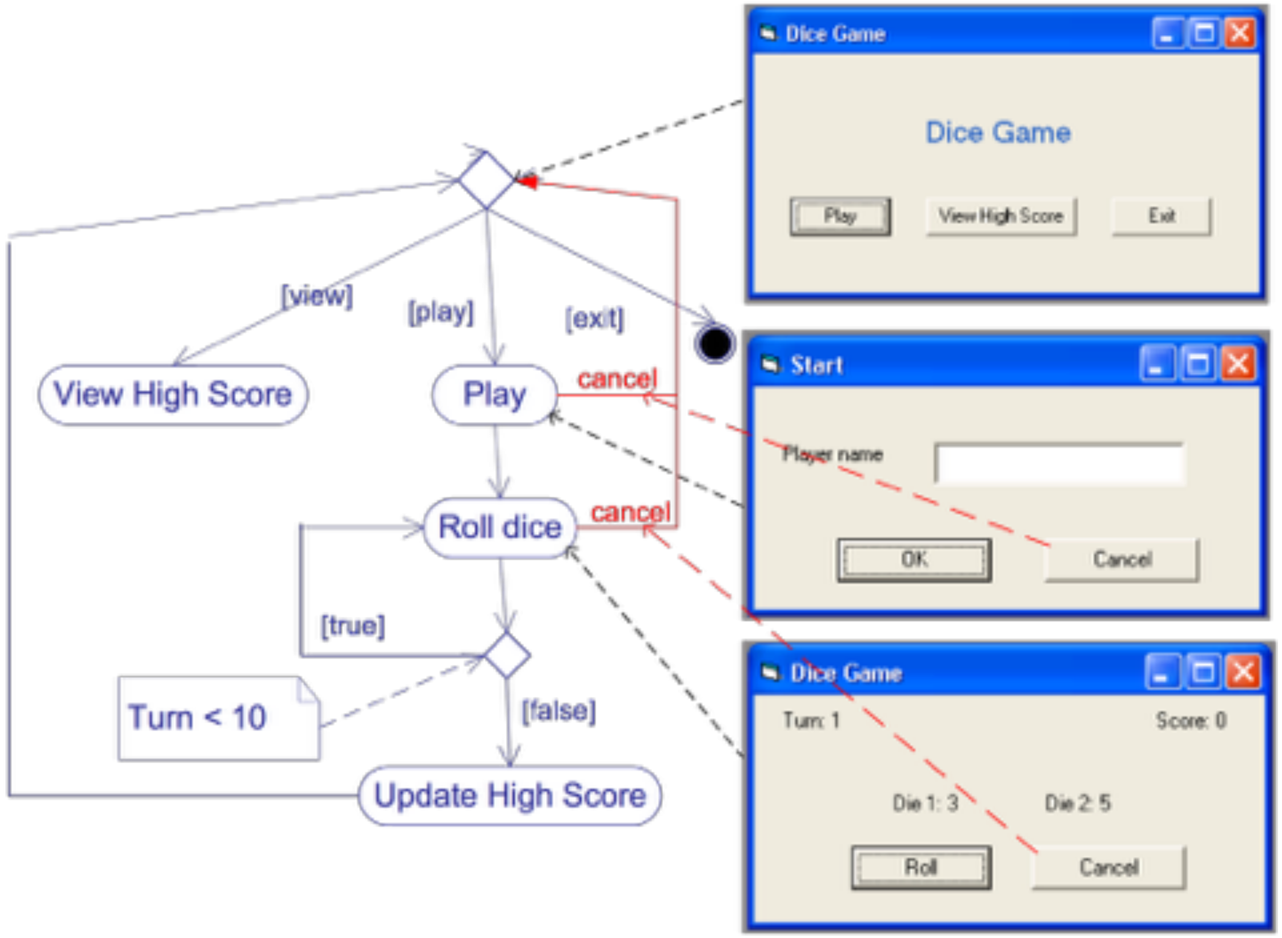
Case study

- Detection of inconsistency between the activity diagram and the state diagram



Case study

- Modification of the activity diagram as well as the envisaged graphical user interface



Turn: 1

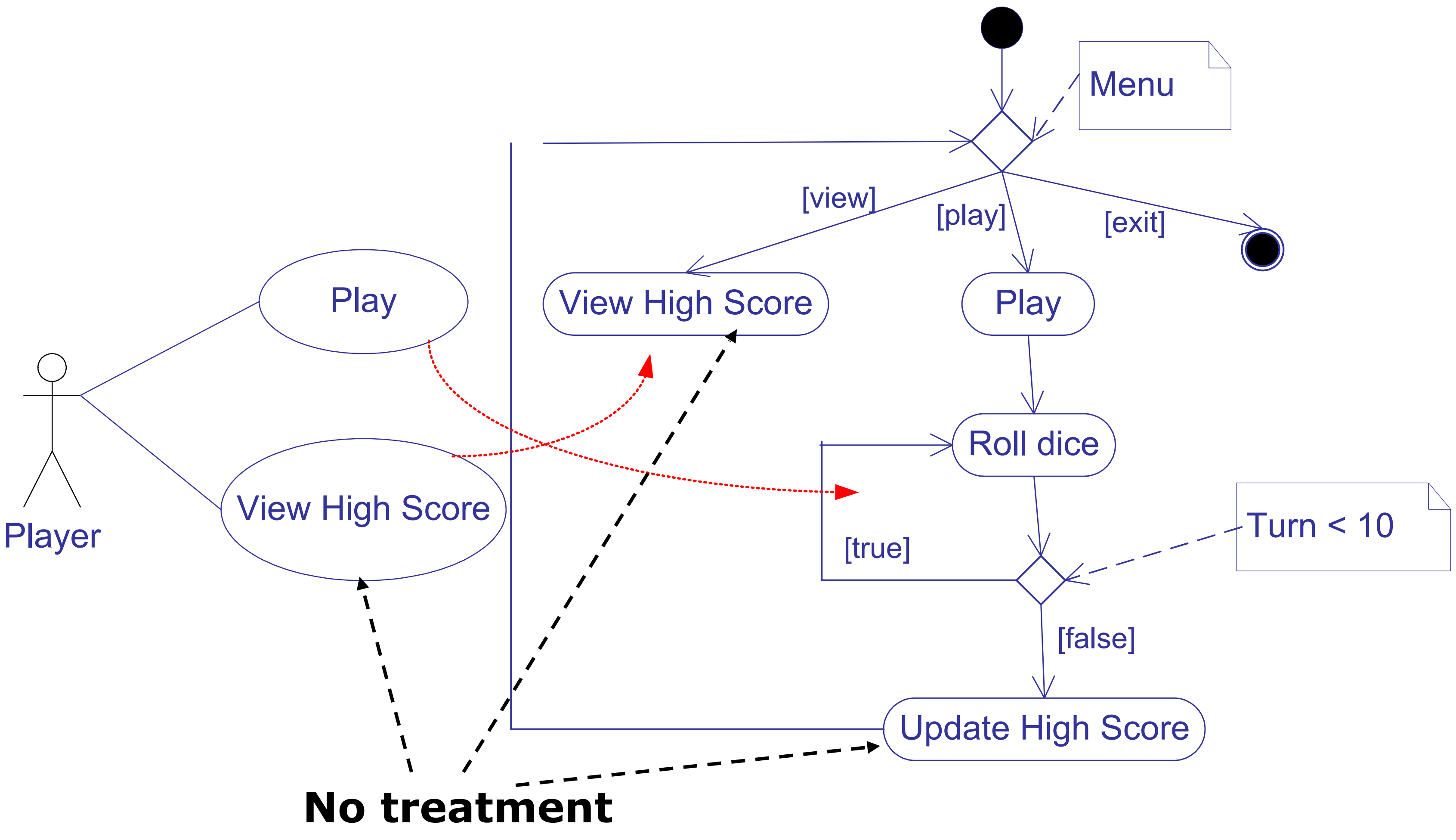
Score: 0

Die 1: 3

Die 2: 5

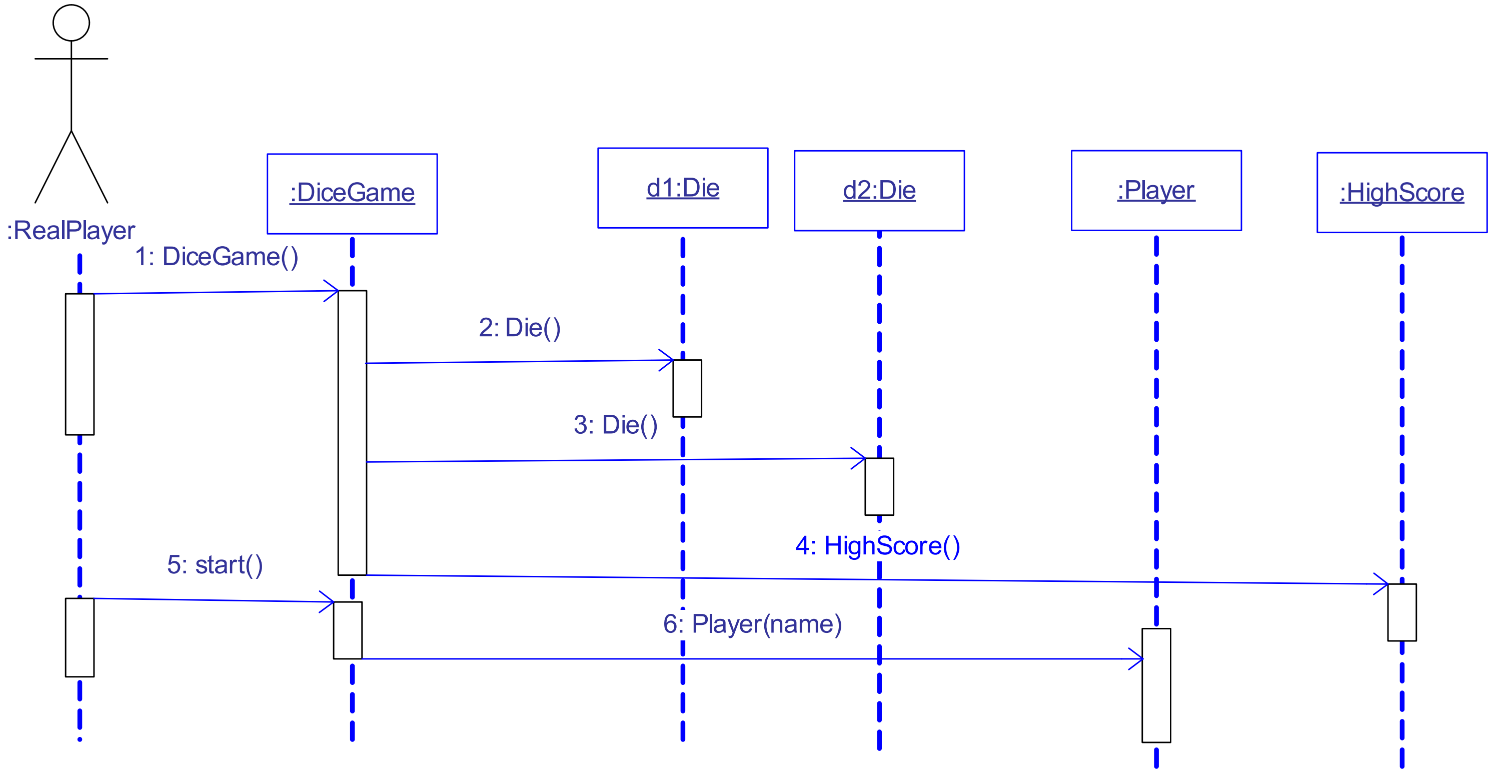
Case study

- The treatment of the scoreboard must be taken into account: the update and the creation



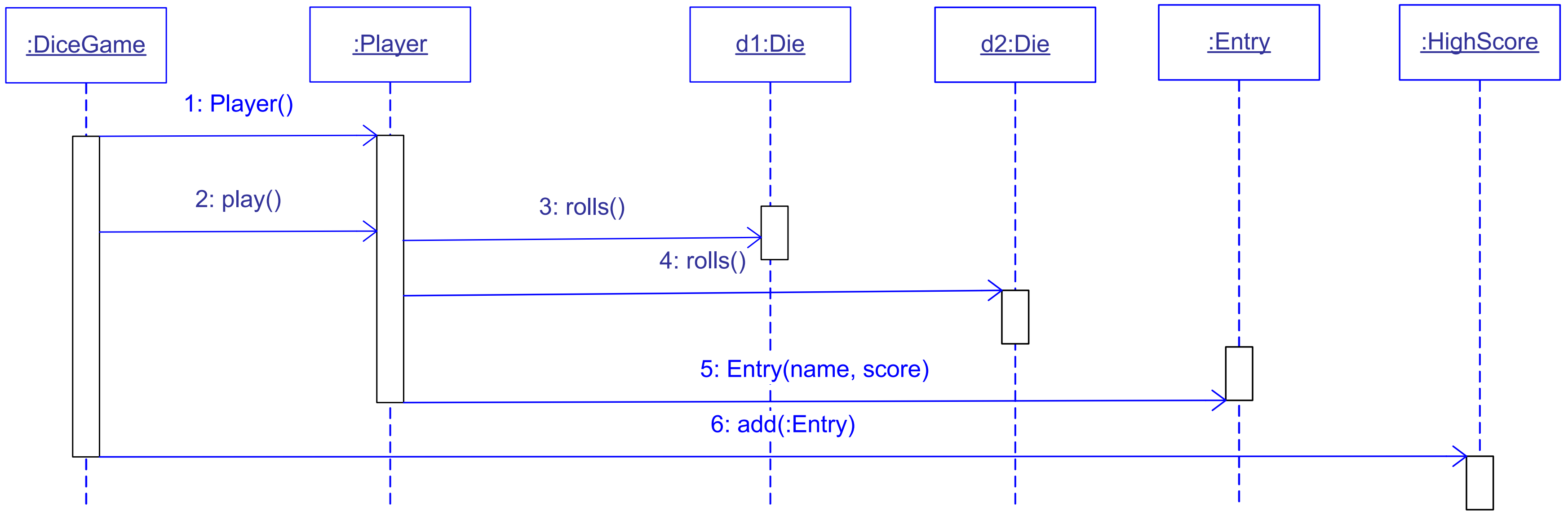
Case study

- Sequence diagram: manage high score, create new player



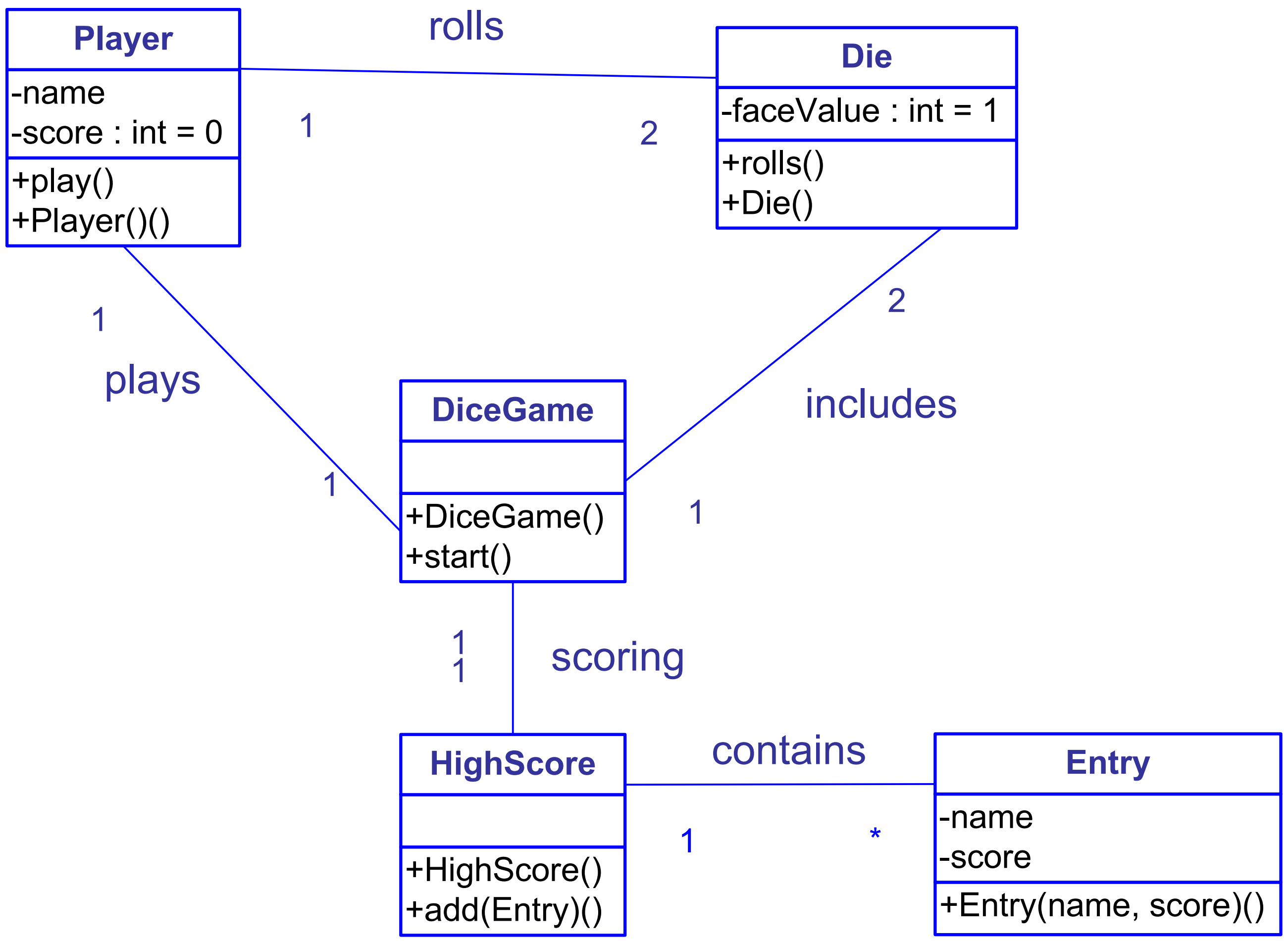
Case study

- Sequence diagram: add high score to score board



Case study

- Class diagram



Main Activities of Software Development

Requirements Gathering

Define requirement specification

Analysis

Define the conceptual model

Design

Design the solution / software plan

Implementation

Code the system based on the design

Integration and Test

Prove that the system meets the requirements

Deployment

Installation and training

Maintenance

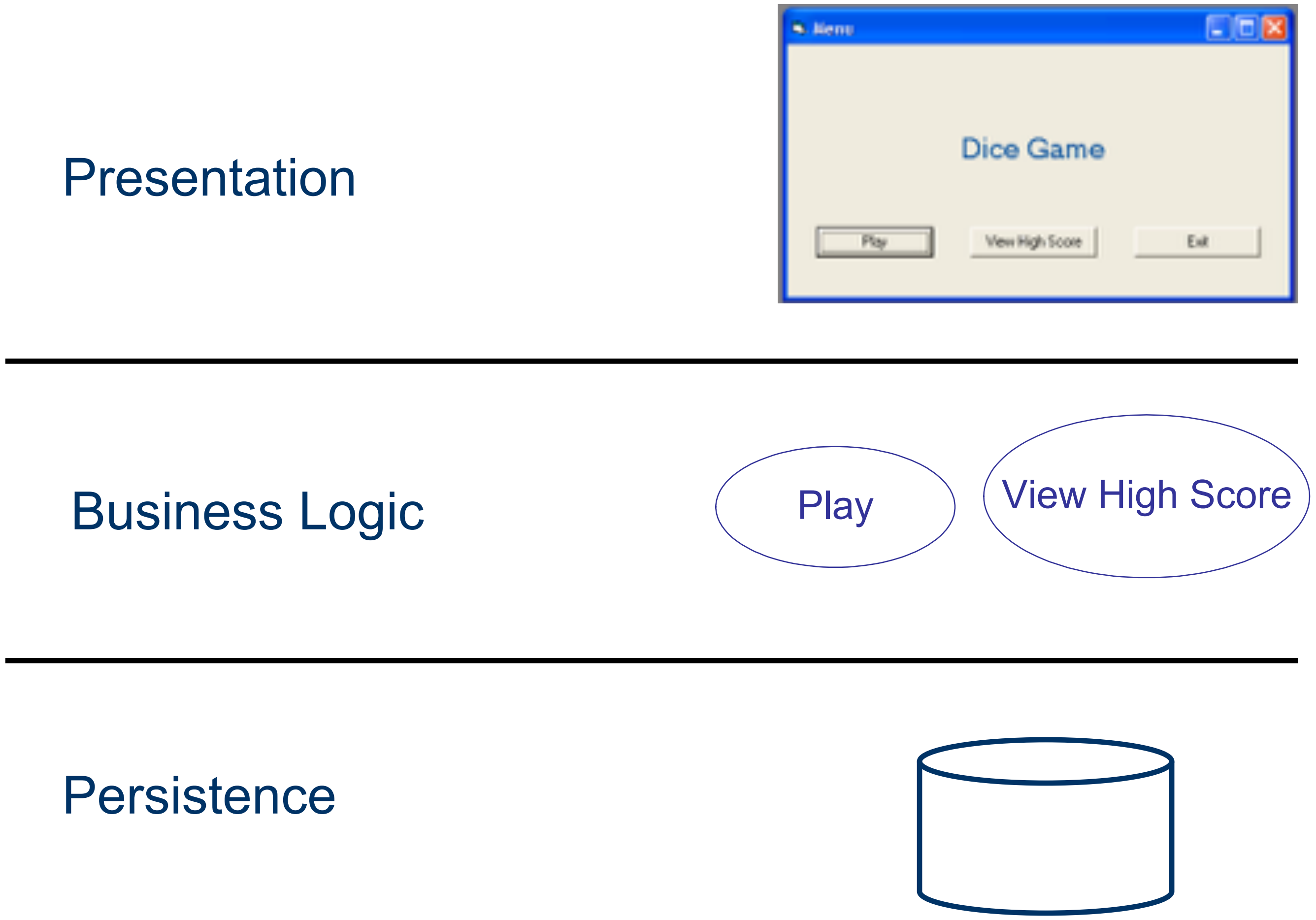
Post-install review
Support docs
Active support

Case study

- Design
  - Take into account the implementation
    - Manage the graphical user interface part
    - Manage the persistence of scoreboard
  - Define the logical architecture
  - Define the physical architecture
  - Introduce the technical class permitting to implement the architecture

Case study

- General architecture
  - Classical three layer architecture



Presentation

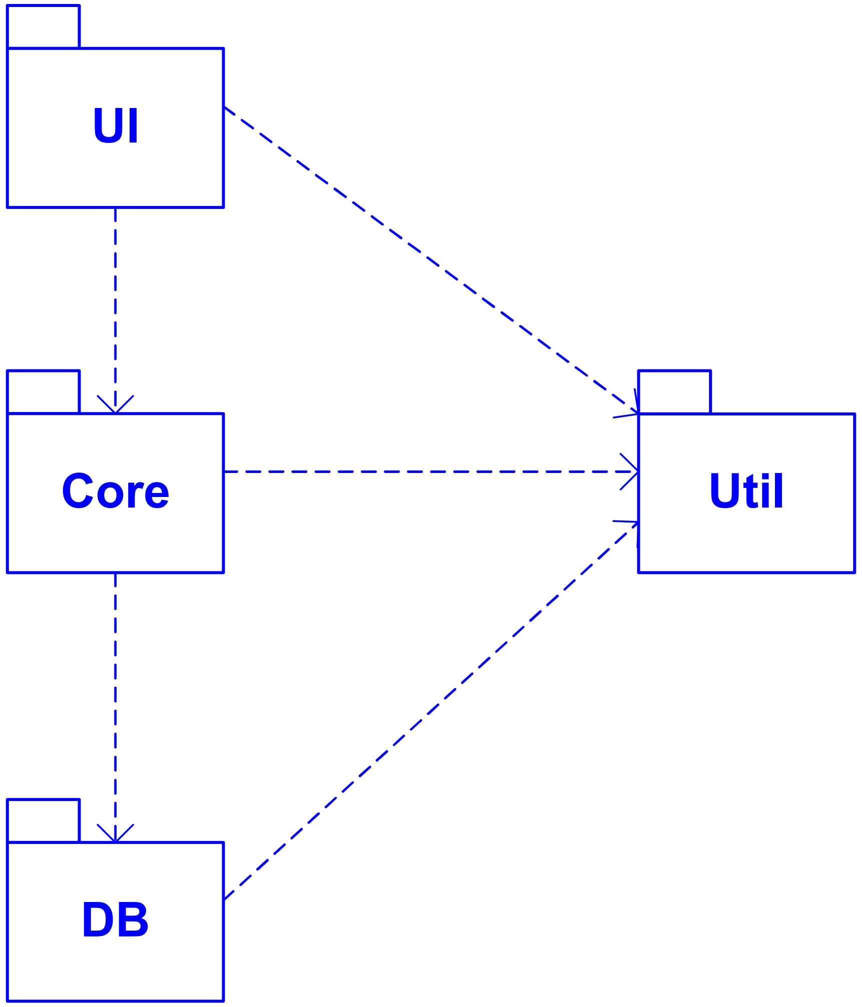
Business Logic

Persistence

Case study

- A package diagram corresponds to the architecture

UI	: presentation layer
Core	: Business logic layer
DB	: Persistence layer
Util	: utility services/classes/functionalities

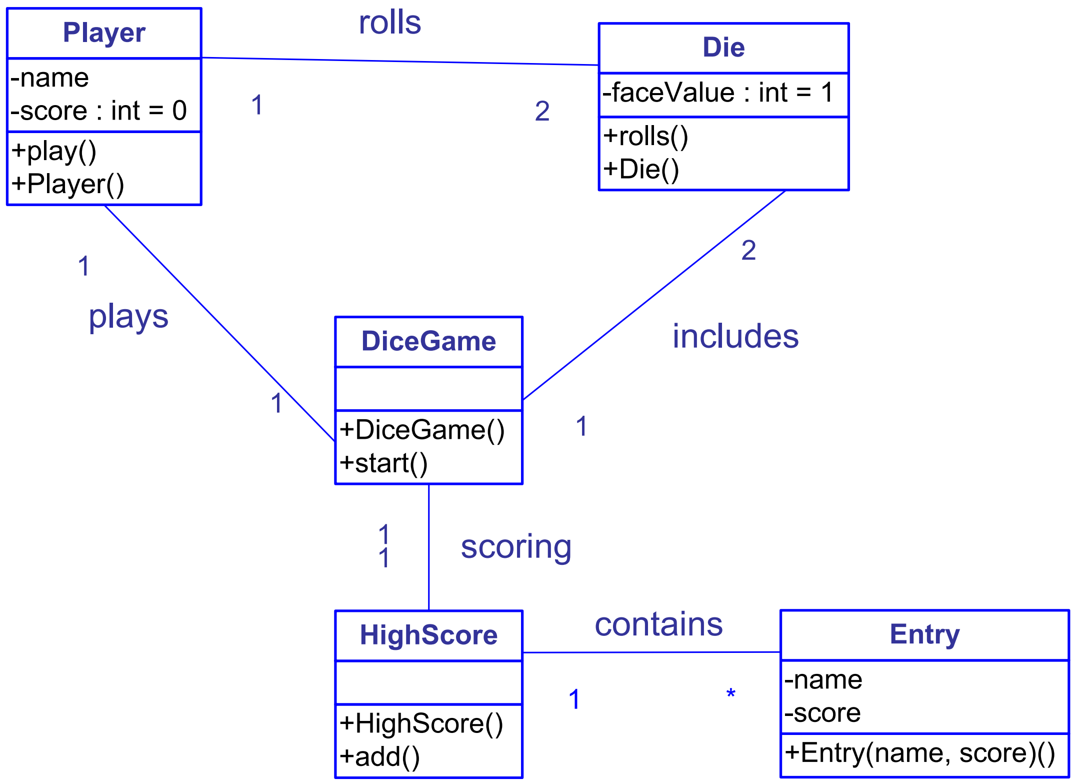


Case study

- Use design patterns to improve the classes of “Core” package

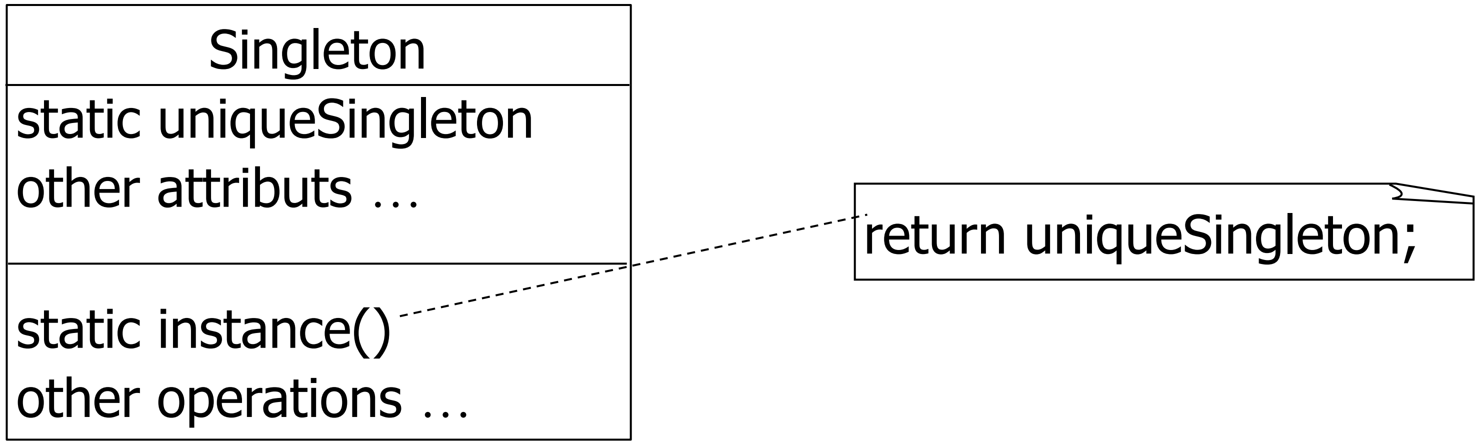
La classe DiceGame ne possède qu’un seul objet
La classe HighScore ne possède qu’un seul objet

Le patron de conception : Singleton



Case study

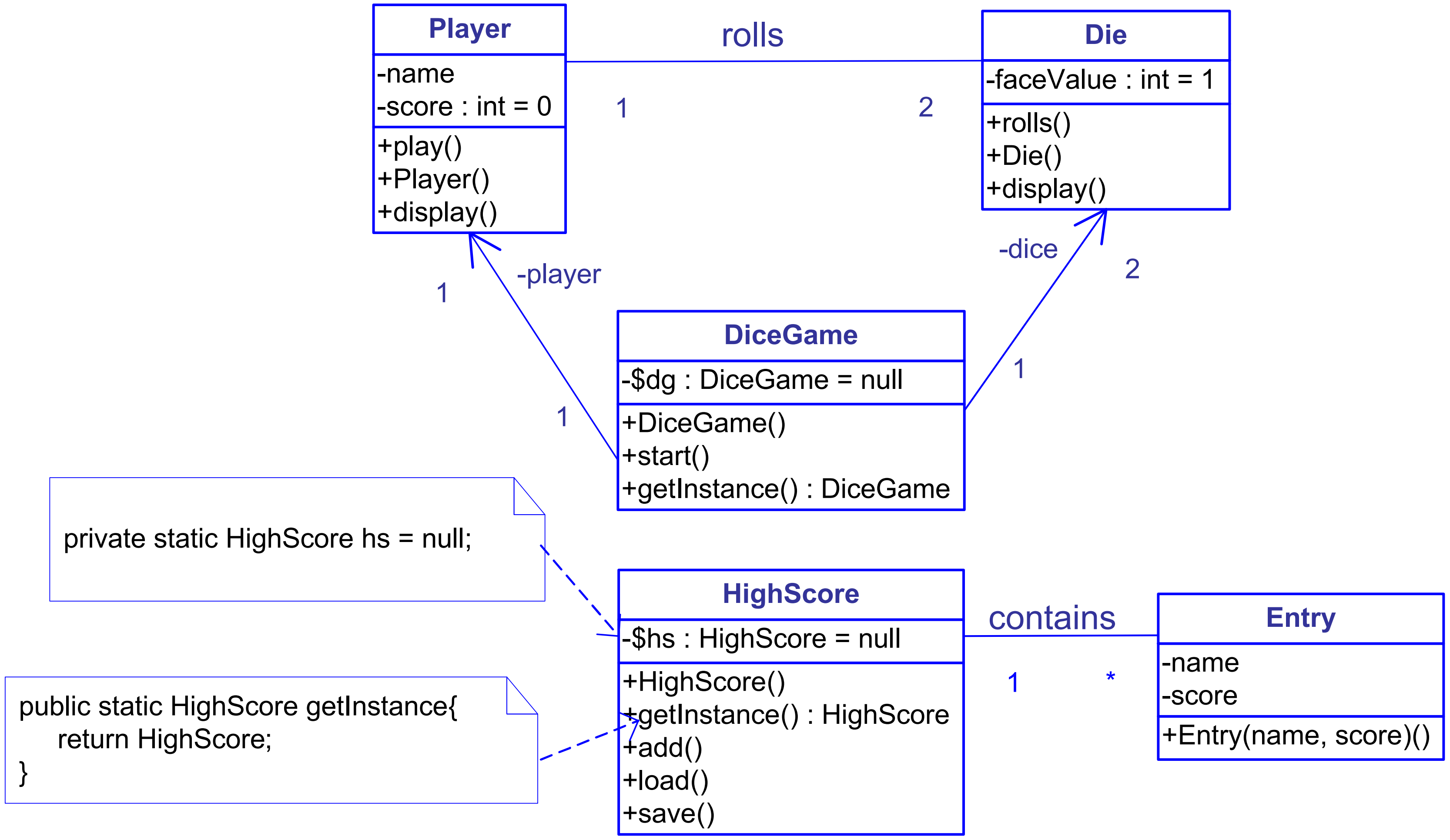
- **Singleton** design pattern



- Application to **DiceGame** and **HighScore**.

Case study

- Modified class diagram

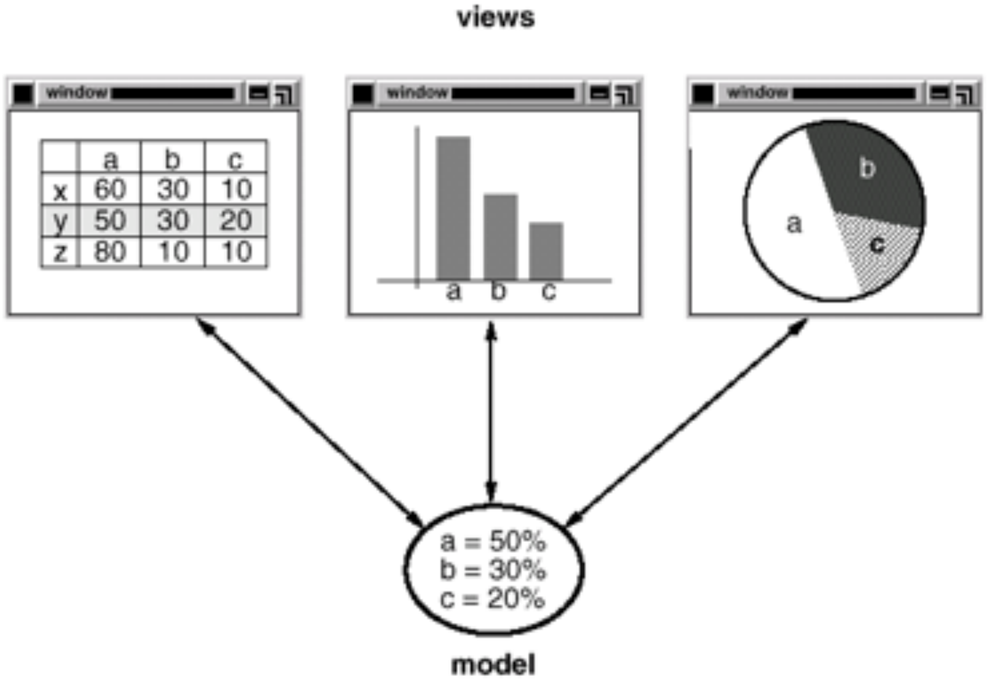


```
private static HighScore hs = null;
```

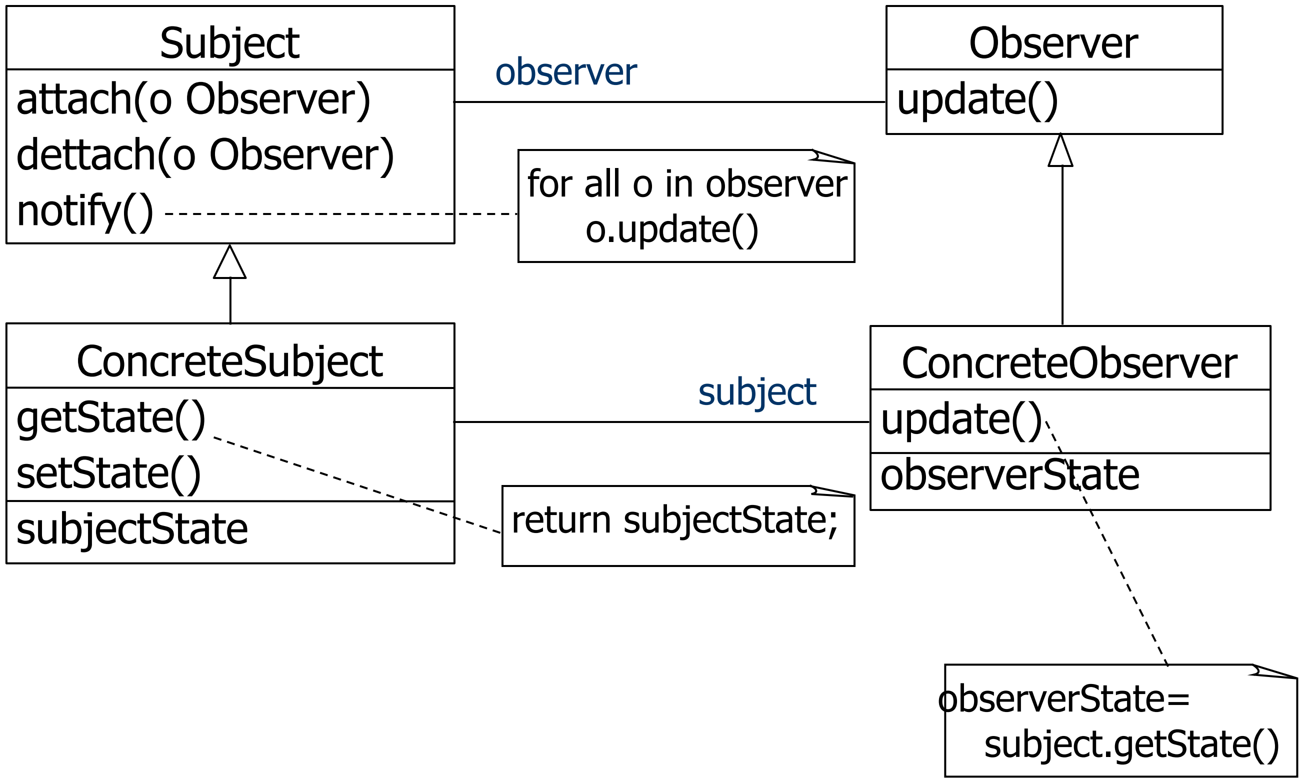
```
public static HighScore getInstance{
     return HighScore;
}
```

Case study

- **Observer** design pattern



	a	b	c
x	60	30	10
y	50	30	20
z	80	10	10



Subject
attach(o Observer)
dettach(o Observer)
notify()

observer

Observer
update()

for all o in observer
o.update()

ConcreteSubject
getState()
setState()
subjectState

subject

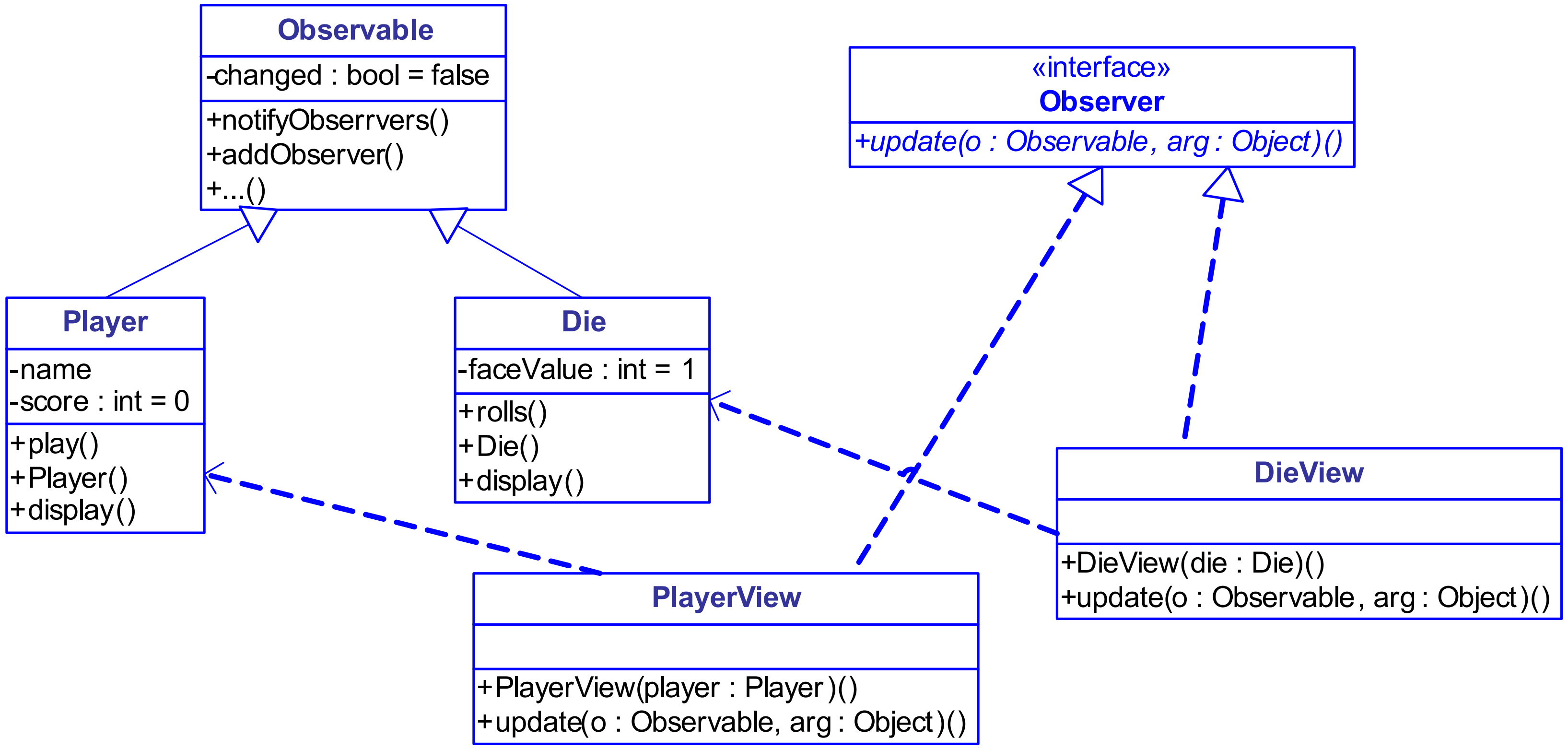
ConcreteObserver
update()
observerState

return subjectState;

observerState=
subject.getState()

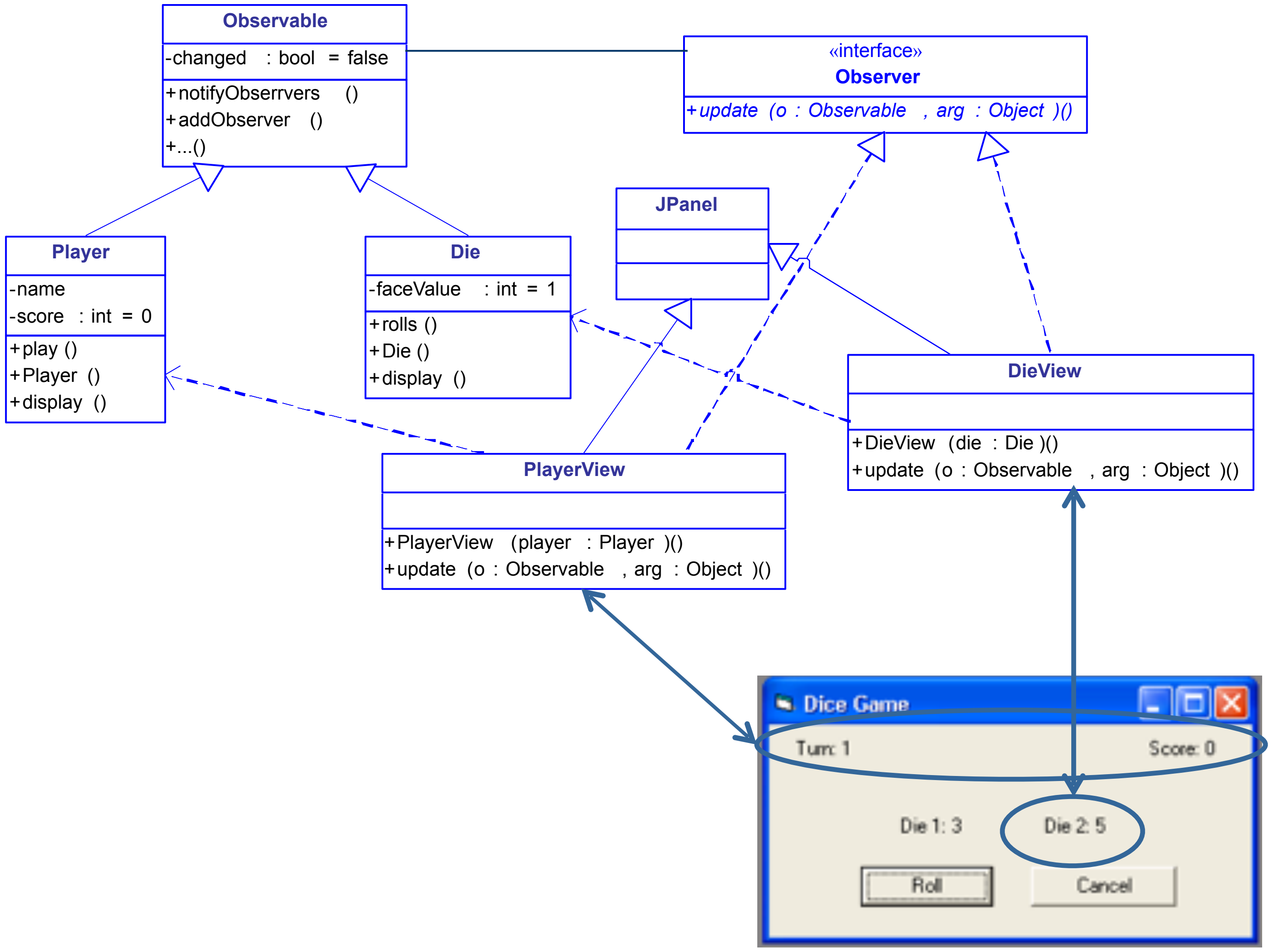
Case study

- Application of **Observer** design pattern to improve the class diagram
  - Decouple the graphical views and objects for the dice and players
  - Application of **Observer** pattern
    - **Die** and **Player** classes are **ConcreteSubject** class
    - Introduce **DieView** et **PlayerView** as **ConcreteObserver** classes



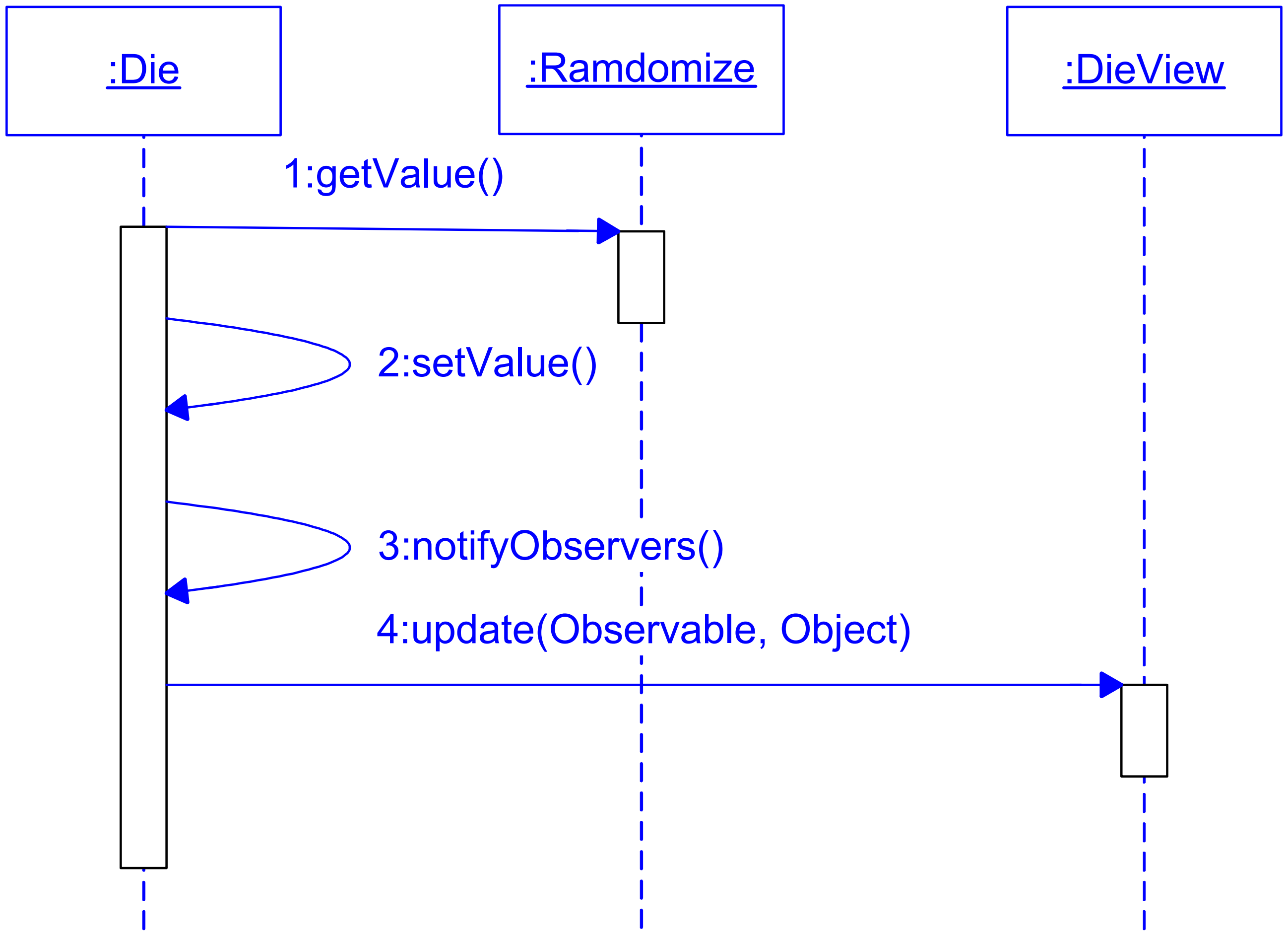
Case study

- User view are instances of *javax.swing.JPanel.java*



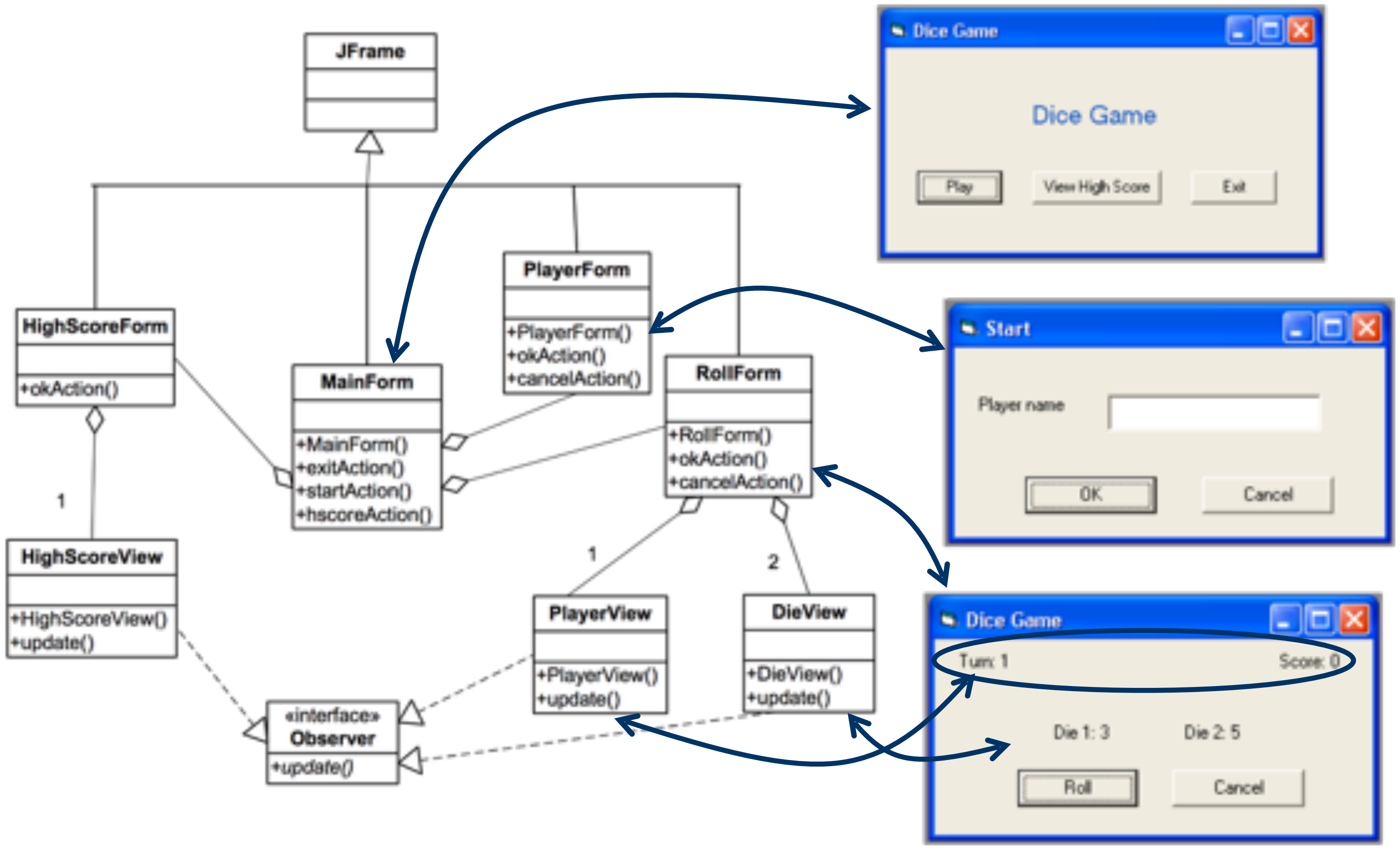
Case study

- Sequence diagram describes the interactions between **Die** object the its view



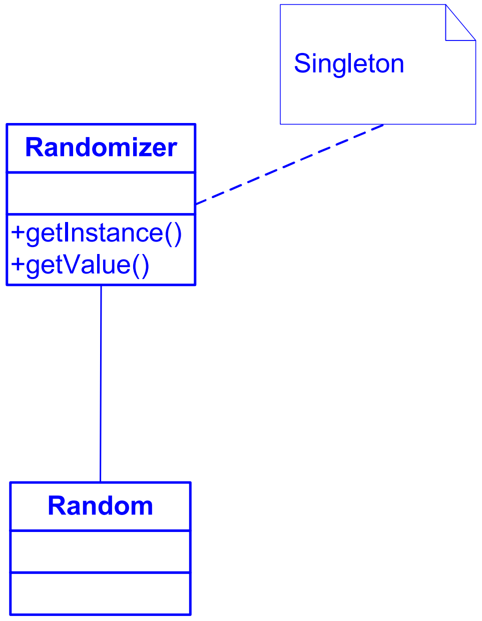
Case study

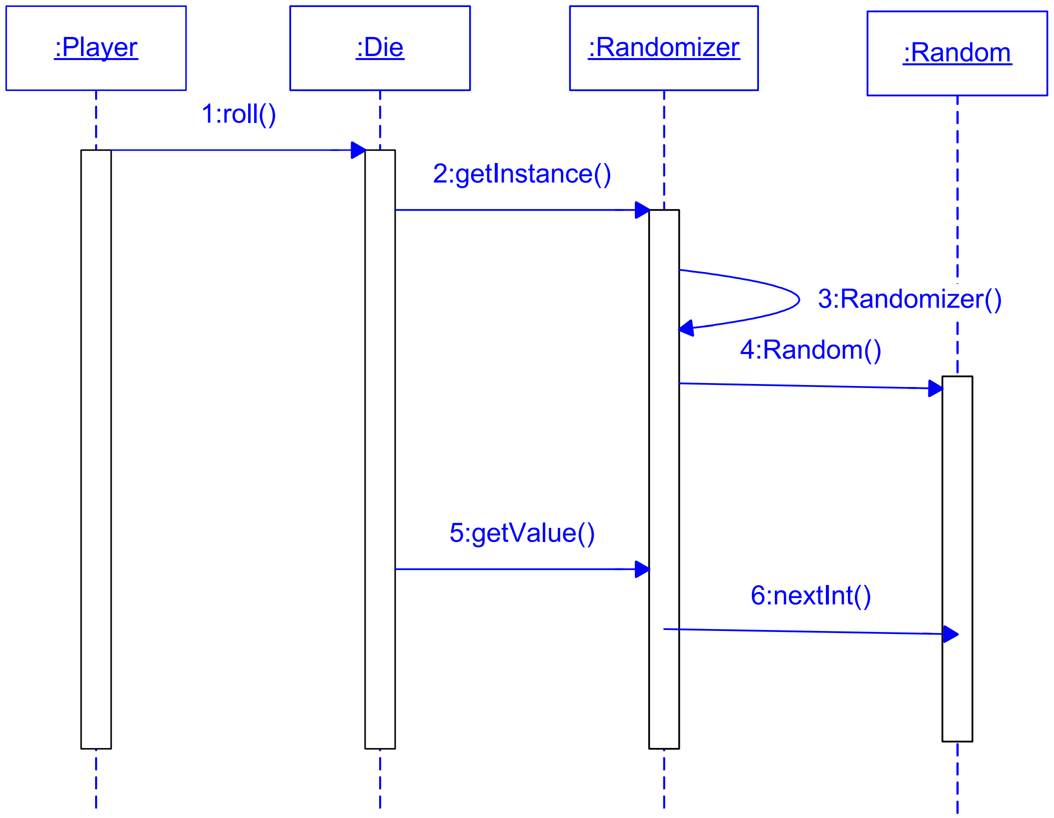
- The design of “UI” package



Case study

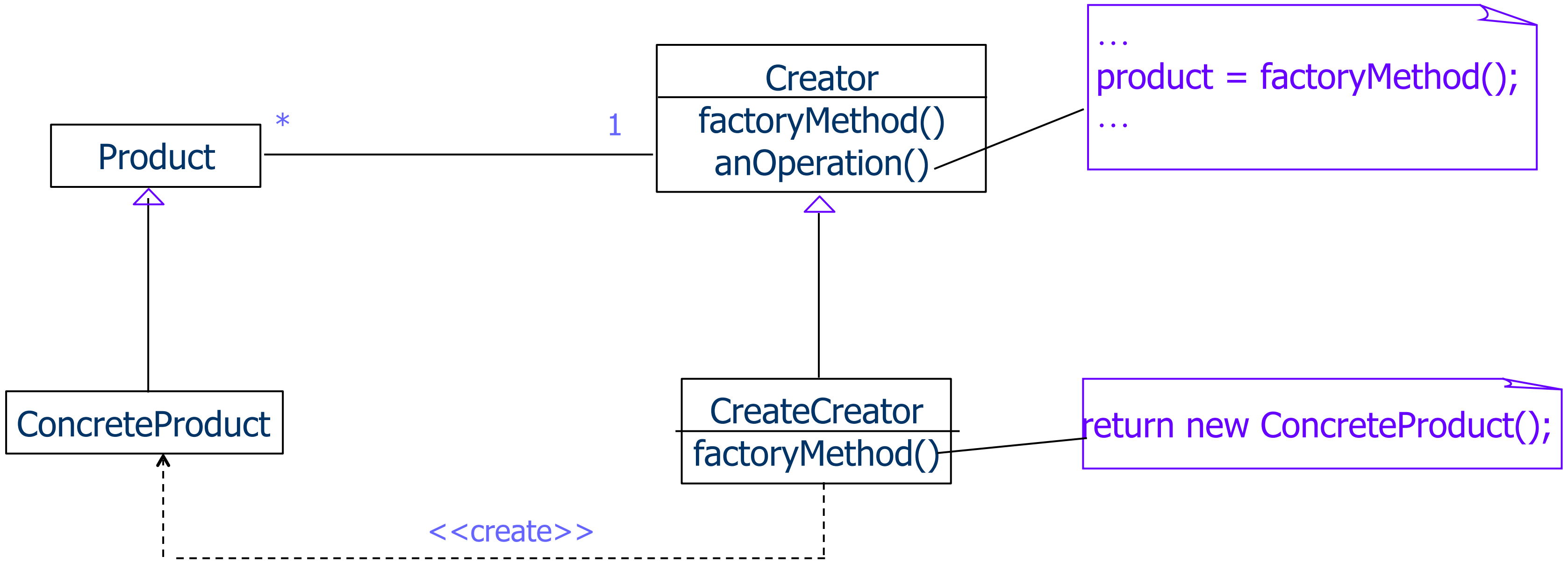
- □ The design of "Util" package





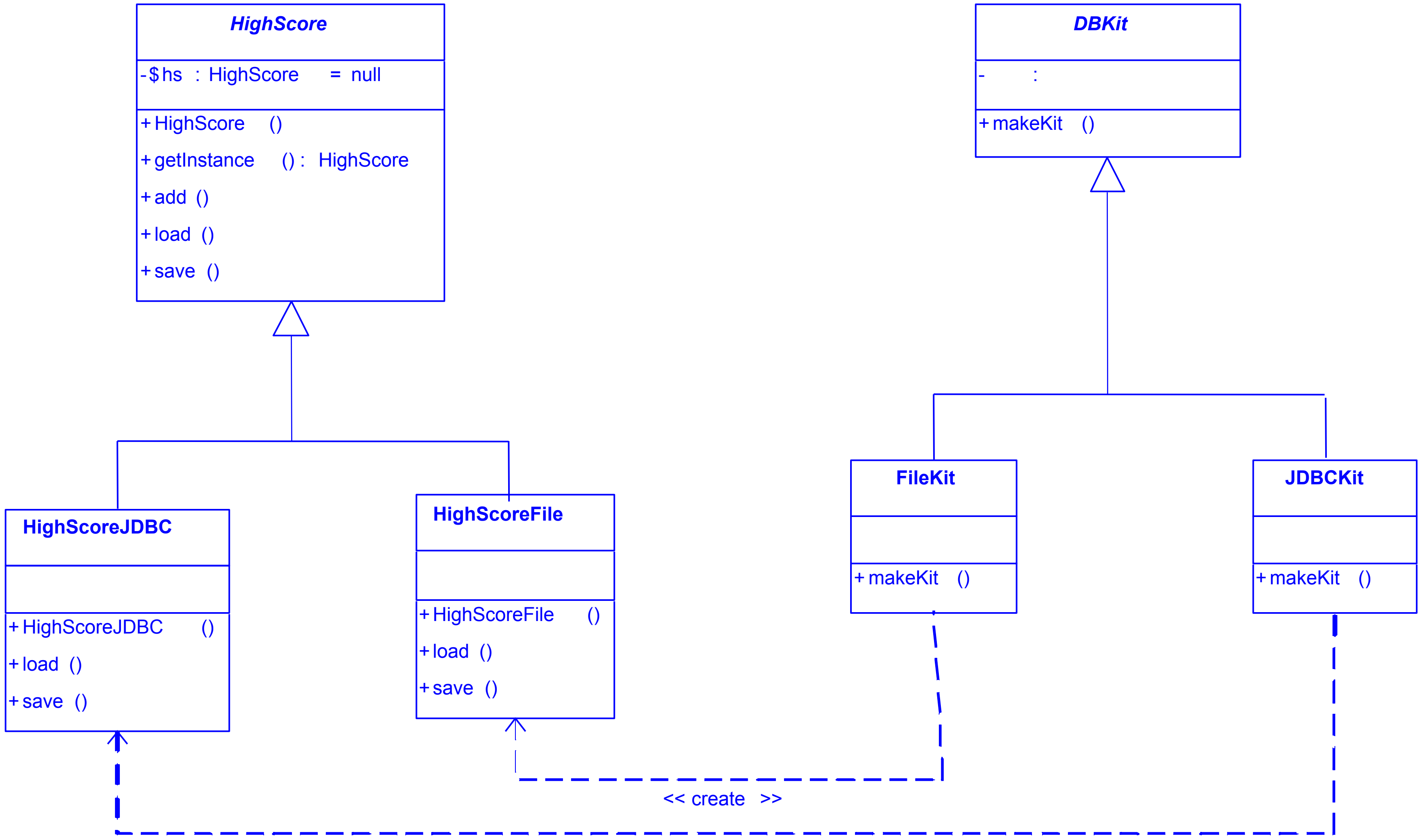
Case study

- The design of “DB” package
  - How to ensure the independence between “Core” and “DB” package
    - In order to be able to use several persistence types
      - File (serialisation)
      - Relation Database Management System (via JDBC)
    - Use **FactoryMethod** design pattern



Case study

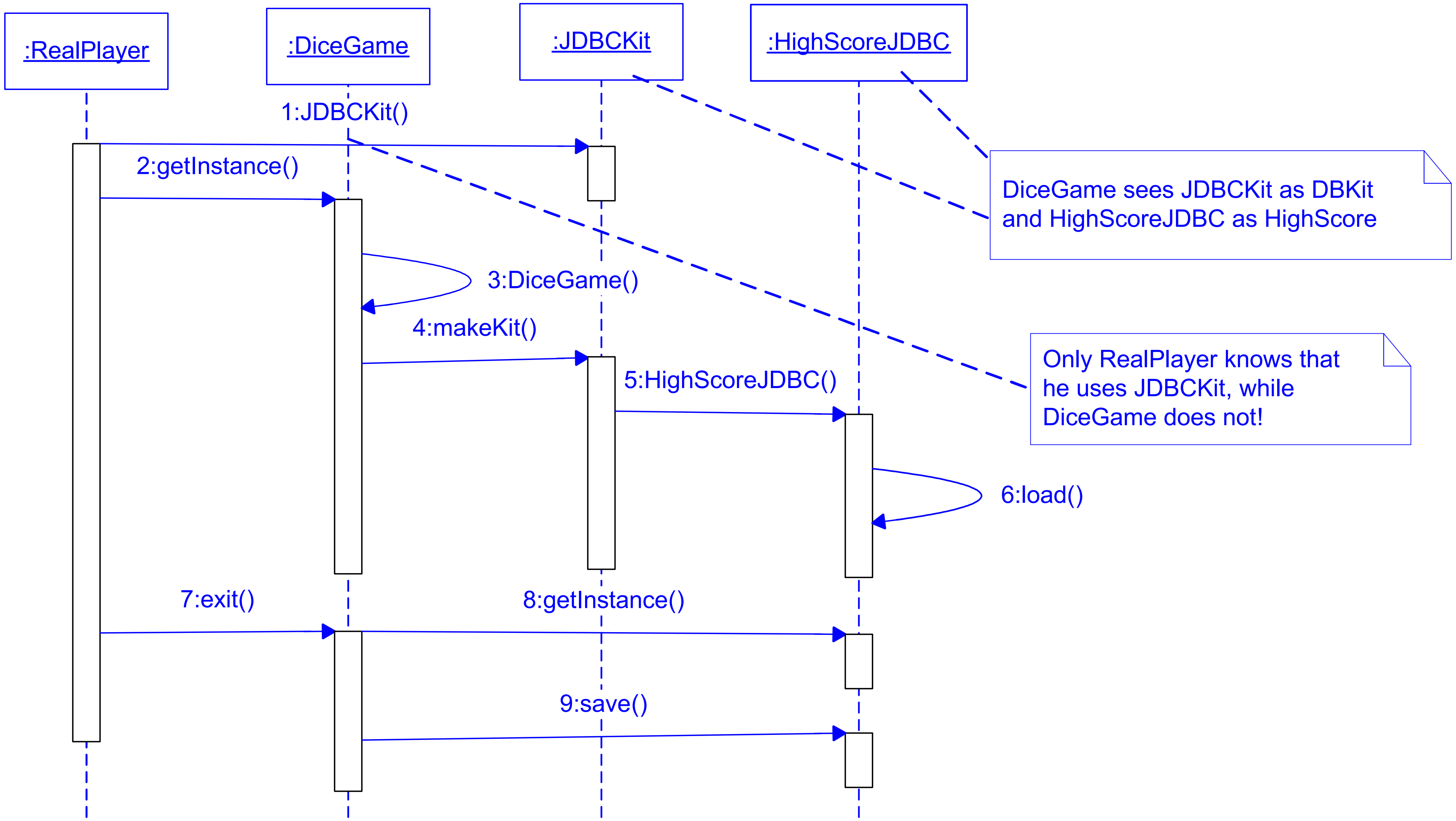
- The design of “DB” package
  - Class diagram



Note : HighScore class is a Singleton

Case study

- The design of the “DB” package
  - Sequence diagram

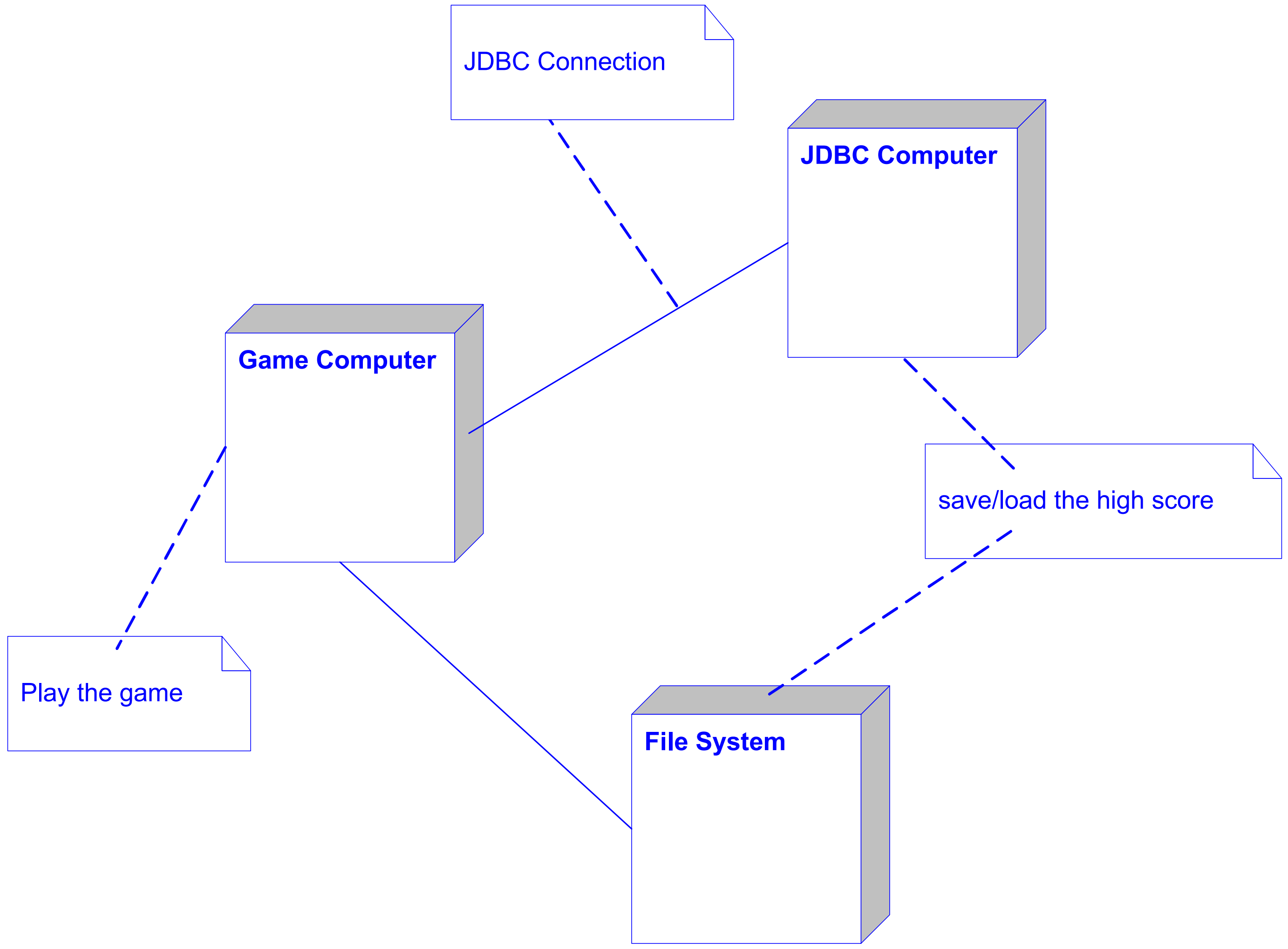


DiceGame sees JDBCKit as DBKit and HighScoreJDBC as HighScore

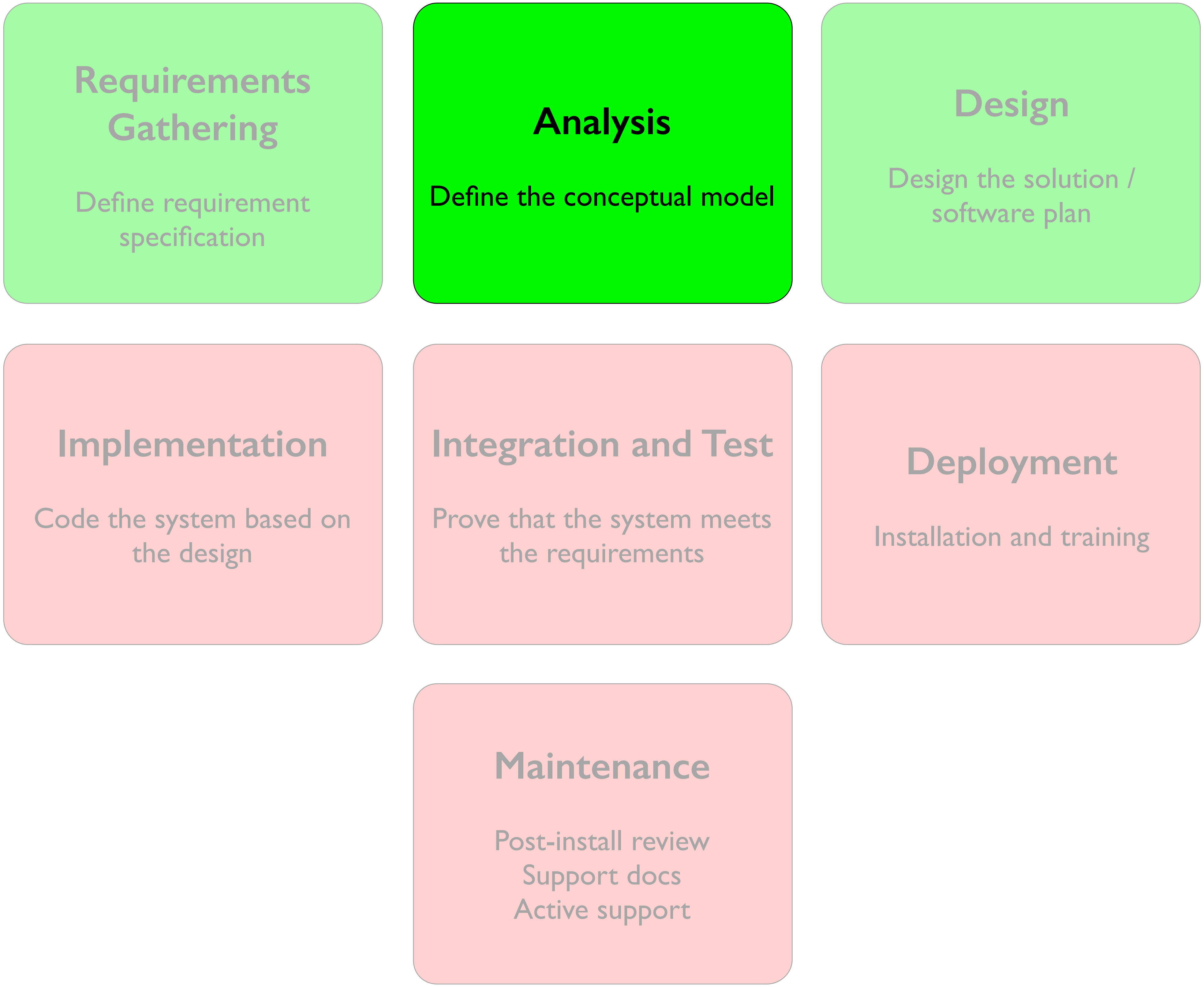
Only RealPlayer knows that he uses JDBCKit, while DiceGame does not!

Case study

- Deployment diagram



Main Activities of Software Development



Requirements Gathering

Define requirement specification

Analysis

Define the conceptual model

Design

Design the solution / software plan

Implementation

Code the system based on the design

Integration and Test

Prove that the system meets the requirements

Deployment

Installation and training

Maintenance

Post-install review
Support docs
Active support

Case study

- Complete the interaction diagrams
- Generate the code