Object Oriented Analysis & Design
面向对象分析与设计

Lecture_03 面向对象分析（一）

主讲: 姜宁康 博士

- 1、面向对象分析与设计概览…
    - Overview of Object-Oriented analysis and design

OOAD Overview

- 良好的对象设计意味着什么?
  - 是构建高质量软件系统的基本要求，如
  - Architectural cohesion 架构性的内聚
  - Reusability 可重用性
  - Maintenance 可维护性
  - Scalability 可扩展性
  - Flexibility 灵活性
- UML、面向对象语言（C++/Java）重要吗？足够了吗？
  - UML是标准的图形表示工具，是一种思考的工具、沟通的形式，是有用的
  - 但是，对象思想才是重点和难点
  - “Owning a hammer doesn’t make you a home builder “拥有一把锤子未必能成为建筑师”

OOAD Overview

- 系统设计中的关键问题 (是本课程要点)
  - 应该如何为对象类分配职责（responsibility）？
  - 对象之间应该如何协作?
  - 什么样的类应该做什么样的事情?
  - 某些针对设计问题的、经过反复验证的解决方案，可以（或者已经）被表示成为最佳实践的原则、启示或者模式（pattern），如何用、如何自创?

- 软件开发过程模型 (不是本课程范畴)
  - 瀑布模型
  - 螺旋模型
  - 增量模型
  - 迭代模型
  - 喷泉模型
  - 敏捷模型
  - SMF（微软）
  - RUP等

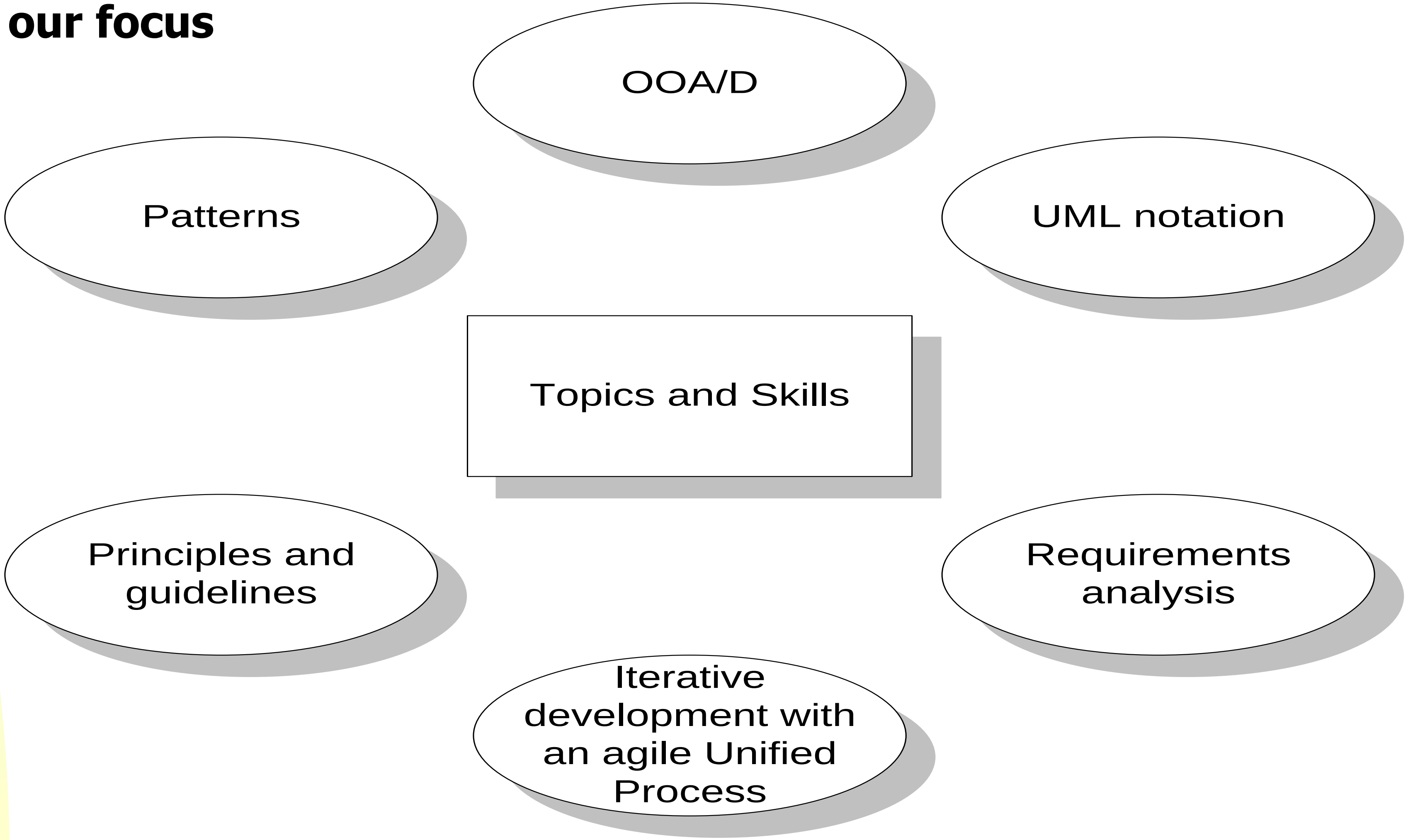
OOAD Overview

- 课程的关键 Key importance:
  - A critical ability in OO development is to skillfully assign responsibilities to software objects. 面向对象开发需要掌握的极为重要的能力：为软件对象分配职责。方法：
    - Responsibility-driven design 职责驱动的设计
    - Performed during Design workflow 在设计的过程中完成职责分配
    - Follows GRASP principles 遵循GRASP原则
      - General Responsibility Assignment Software Pattern 通用职责分配软件模式
    - Successful designs become Patterns 成功的设计可以成为模式
      - A named description of a problem, solution, when to apply the solution, and how to apply the solution in new contexts 一个命名的描述：问题、解决方案、何时适用、如何应用在新的环境

- 相关的知识点
  - 用例 Use Cases
    - 文字描述的重要交易和业务场景 Text description of vital transactions and scenarios
    - 用例不是面向对象的，但面向对象分析设计都会用到 Not OO but usually used in OOAD

OOAD Overview

- **Topics and skills covered**
  - **OOAD elements**
  - **OOAD + UML is our focus**


OOA/D
Patterns
UML notation
Topics and Skills
Principles and guidelines
Requirements analysis
Iterative development with an agile Unified Process

OOAD Overview

- **What is Analysis ?**
  - **Analysis is investigation of the problem and requirements, rather than a solution.**
    - **For example, if a new online trading system is desired,**
      - **how will it be used? What are its functions?**
    - **requirements analysis： an investigation of the requirements**

- **What is design?**
  - **Design is a conceptual solution that fulfills the requirements 概念性的、满足需求的解决方案**

- **分析与设计的类比：**
  - **用户需求：我要一辆能开动的汽车**
  - **系统功能：引擎、方向盘、油箱轮胎、车架、车门....**

OOAD Overview

- **What is implement? 实现**
  - Implementation is expression of the design in code
    - Emphasis on utilizing the language of choice to implement design classes while exploring visibility, navigability, etc.
- **What is deployment? 部署**
  - Deployment is the actual installation in the host environment
- **Relationship of the Analysis and Design 分析与设计的关系**
  - 记住这句话：

    " do the right thing (analysis), and do the thing right (design) "

    做正确的事情（分析）、正确地做事情（设计）

OOAD Overview

- **What is OOA 面向对象分析?**
  - **finding and describing the objects or concepts in the problem domain 发现并描述问题领域里的对象或者概念（概念类）**
- **What is OOD 面向对象设计?**
  - **defining software objects and how they collaborate to fulfill the requirements 定义软件对象、以及它们之间如何协作完成功能的（设计类）**
- **For example, Airplane example of object and class discovery**
  - **OOA:**
    - **in the case of the flight information system, some of the concepts include: Plane, Flight, and Pilot.**
  - **OOD:**
    - **a Plane software object may have a tailNumber attribute and a getFlightHistory() method**
  - **then, implement…**

OOAD Overview

- 实例 For example, Airplane example of object and class discovery

domain concept

Plane
tailNumber

visualization of domain concept

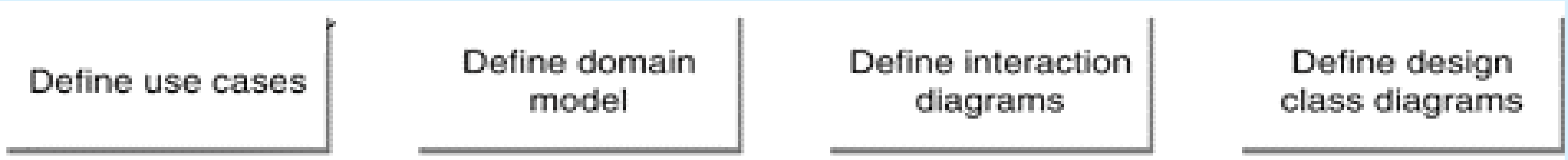
```
public class Plane
{
private String tailNumber;

public List getFlightHistory() {...}
}
```

representation in an object-oriented programming language

OOAD Simple Example

- Rudimentary process 最基本的过程



定义用例 定义领域模型 定义交互图 定义设计类图

- Dice game example
  - software simulates（模仿）a player rolling two dices. If the total is (>=) seven, they win; otherwise, they lose

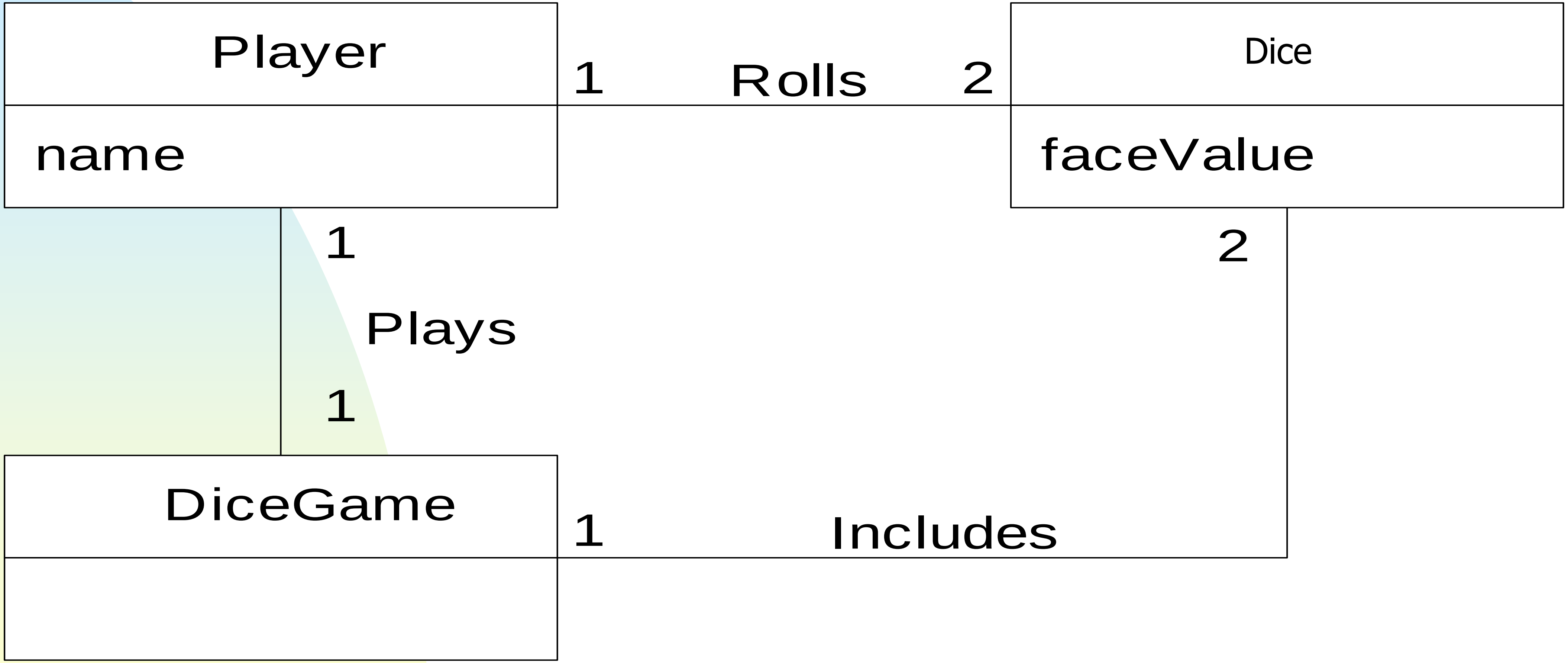
OOAD Simple Example

- **Step1: Use Case**
  - **Player is requested to roll the dice.**
  - **System presents results:**
  - **If the dice face value totals (>=)seven, player wins; otherwise, player loses**

OOAD Simple Example

- Step2: Domain Model 领域模型
  - OOA的结果体现在领域模型中，显示重要的领域概念或者对象
  - What is domain model?
    - a visual representation of conceptual classes or real-situation objects in a domain [MO95, Fowler96]. 问题领域的概念类以及真实对象的可视化表示
    - Domain models have also been called conceptual models , domain object models, and analysis object models. 领域模型也被称为 概念模型、领域对象模型、分析对象模型
  - In our example,
    - Player,
    - Dice,
    - DiceGame

OOAD Simple Example



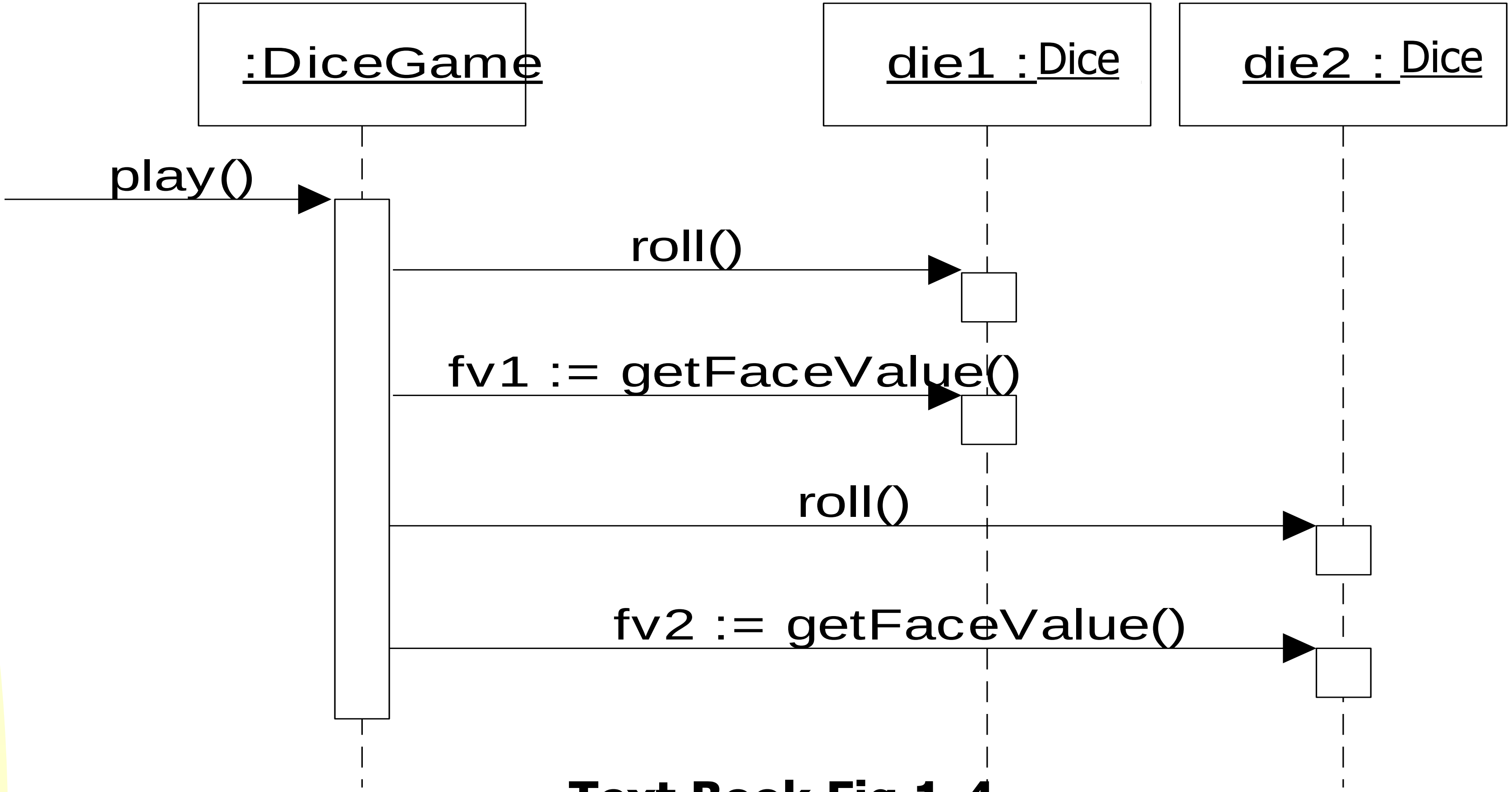
Text Book Fig 1-3

OOAD Simple Example

- **Step3: Interactions**
  - **Assignment of responsibilities among objects**
  - **Sequence or Communication diagrams**

注意：

在现实里，是Player扔的骰子。在软件设计中，由DiceGame对象扔骰子dice（即,给Dice 对象发送一个消息)。 软件设计需要从真实世界的事物中获取一些灵感、启发，但是，不能完全模仿真实世界。



Text Book Fig 1-4

OOAD Simple Example

- **Step4: Design Class Diagrams (DCD)**
  - **Software classes（软件类） with methods according to responsibilities and attributes according to visibility**

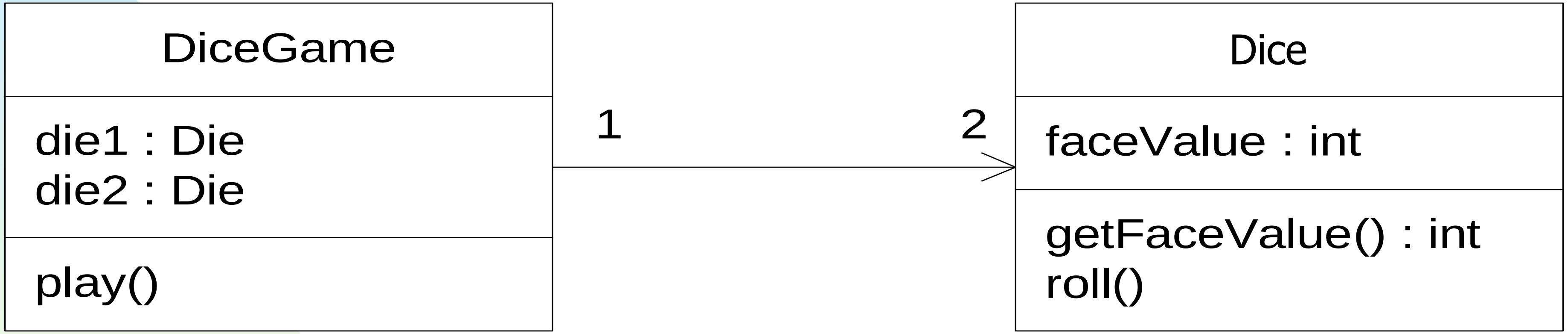


Figure 1.5. Partial design class diagram

- **Cf:**
  - **the domain model showing real-world classes**
  - **this diagram shows software classes**
- **LRG: lower representational gap,低表示差异**
  - **概念类与软件类，有很大的相似度**

OOAD概述小结

- 领域、领域模型、概念类
- 系统、设计类==软件类
  - 低表示差异LRG： 概念类可以直接作为软件类
  - 概念类没有操作、软件类有操作
- 分析、设计，面向对象分析、面向对象设计
- OOAD的简单完整过程示意
  - 掌握面向对象思想，重于UML工具、OO语言

- **本讲结束**