COM S 362
Object-Oriented Analysis & Design

Analysis and Design Process Overview

Reading

Craig Larman. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 2005.

Read Chapter 1 from the beginning, stop before "What is UML", pp. 3-11.

Warmup

- What are the code smells?
- What violated principles are causing the code smells?
- What refactoring steps would you take?

```
public class BodyMass {

        public void calculateEverything(String name, double height,
             double weight, int age) {
                System.out.printf("%s's BMI is %.2f", name,
             (703 * weight / (height * height))
        );
        }

        public static void main(String[] args) {
                BodyMass lp = new BodyMass ();
                lp.calculateEverything("John", 67, 150, 20);
        }
}
```

Design Process: A Short Example

- Example: A dice game in which software simulates a player rolling two dice, if the total is seven, they win; otherwise, they lose.
- Design Activates (does not imply sequential execution)
  - Define use cases
  - Define domain model
  - Define interaction diagrams
  - Define design class diagrams

Use Case

- Use cases are written stories
- Describe an actor's interaction with the system
- Not a diagram, not pseudocode, not logic

Simplified use case example:

Play a Dice Game: Player requests to roll the dice. System presents results: If the dice face value totals seven, player winds; otherwise, player losses.

Use Case Template

- Example use case

Use Case: Move an item.

Primary Actor: User
Triggering Event: User selects an element and *click-and-drag*s to move the object.
Success Guarantee: Item is in the new location.
Preconditions: A diagram is open with at least one element in diagram or side panel.
Main Success Scenario:

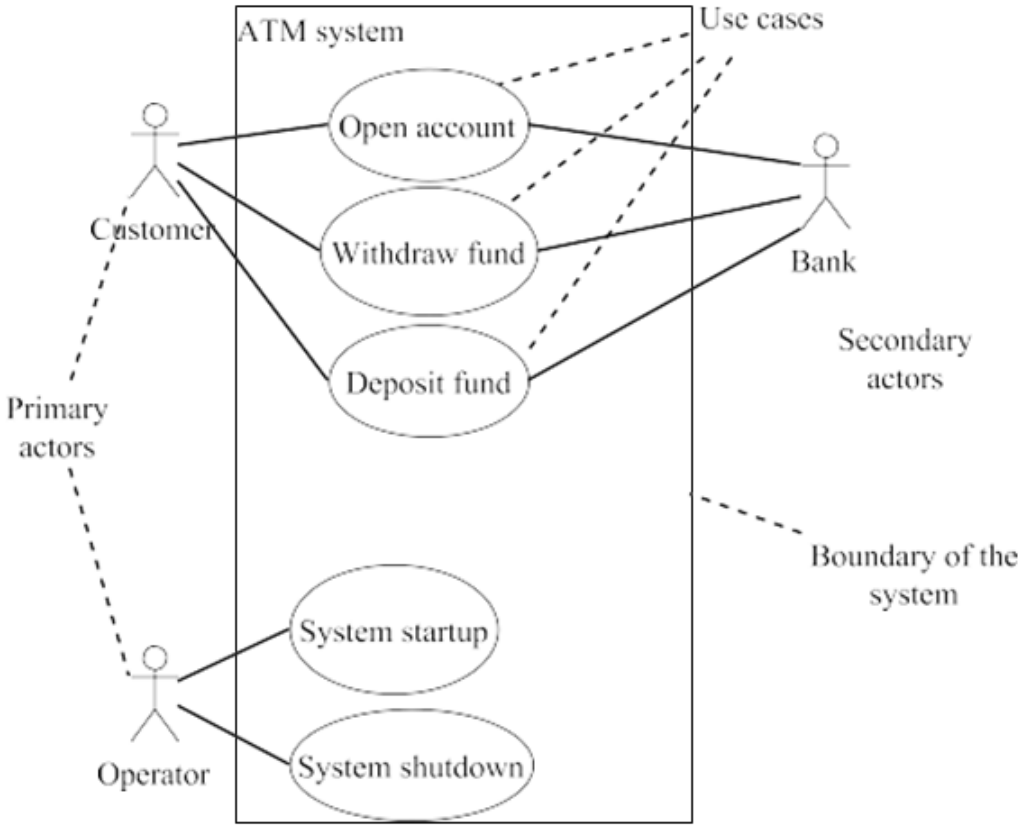
1. A new object is selected.
2. That new object is dragged to a new position.
3. The system moves the item to the new position.

Extensions/Alternatives:

1. Moving item with attached relation, Relation endpoint stays "anchored" to the moving item.

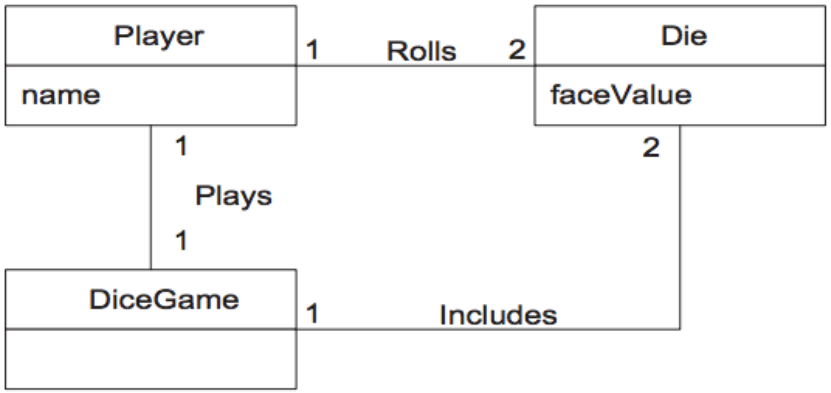
Use Case Diagrams

- Use case diagrams show the associations between actors and use cases for a system
- Visual catalog of use cases



Domain Model

- Visualization of concepts or mental models of a real-world domain
- Not software classes/objects
- Used for communicating with domain experts



Responsibilities and interaction diagrams

- Key skill of object-oriented design is assigning responsibilities
- Collaborations described in interaction diagrams
  - Sequence
  - communication diagrams
- Example: who has responsibility for rolling the die?

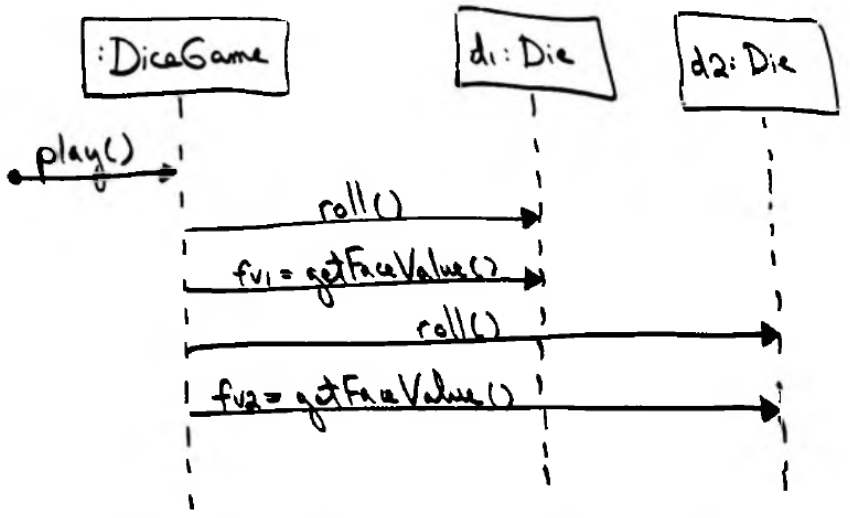
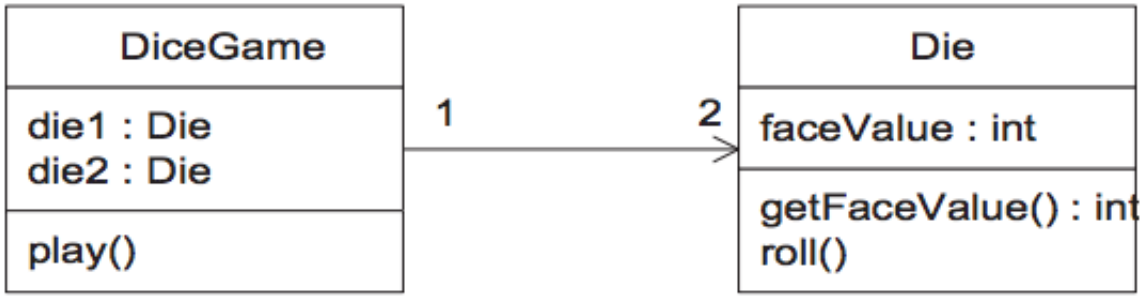


Figure 1.4 Sequence diagram illustrating messages between software objects.

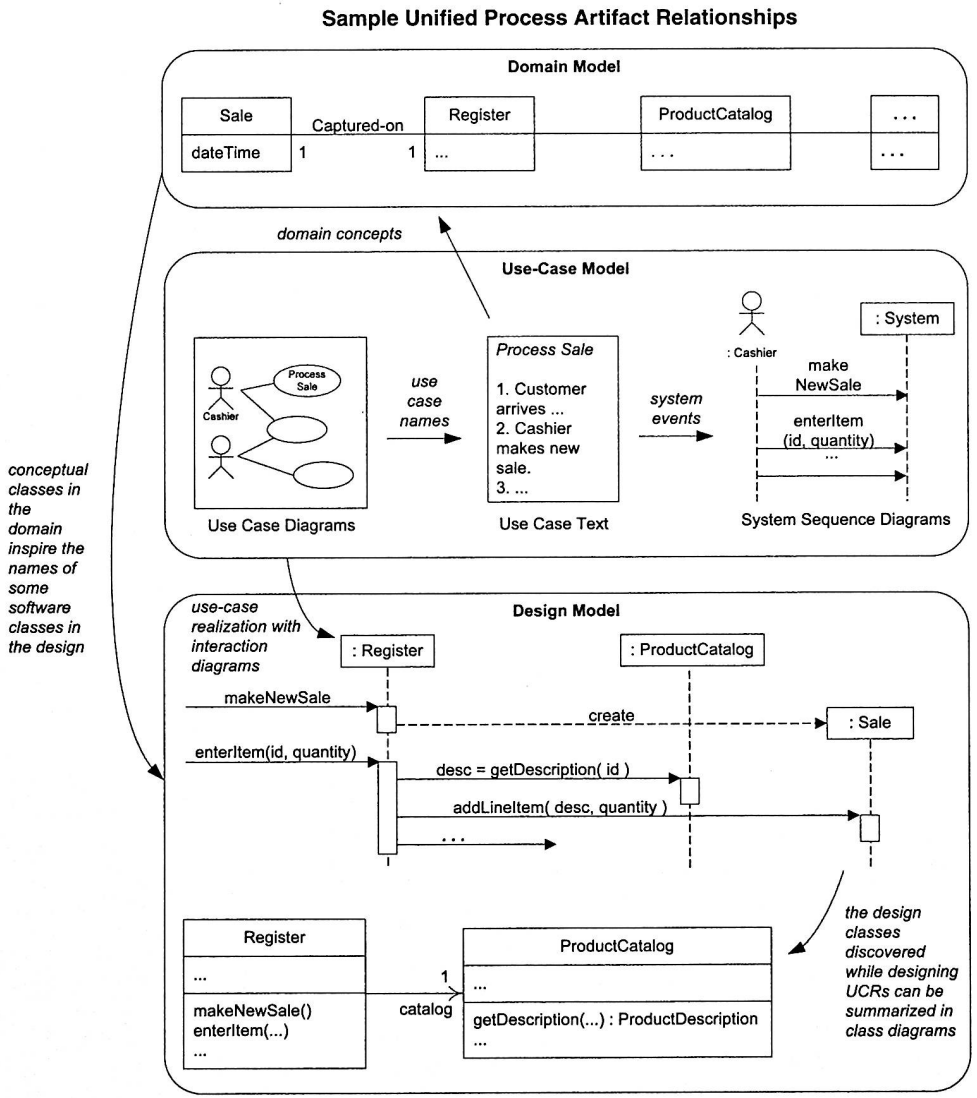
Design Class Diagrams

- The design class diagrams show software classes
- OO design support a **low representational gap** between software components and the domain



UP Artifacts

- Diagram indicates how artifacts inform each other, but it does not imply sequential execution of project



Use Case Definitions

- **Stakeholders:** Anyone with an interest in or an effect on the outcome of the product/project. (Robertson & Robertson, 3rd, p44)
- **Actors:** Anything outside of the system (typically people) with a behavior. A source of triggering events.
- **Requirements:** Capabilities and conditions to which the system must conform. (p.54)
- **Use Case:** Text Documents. A collection of related scenarios. (p.63-64) Not a flow chart!! Not pseudo-code.
- **Scenarios:** A description of an actor or actors using the system to support a goal. (p. 63) The primary source of requirements

A (tiny) Case Study

- Imagine you work at the coffee shop in the library. Depending on the time of day and the number of customers, the manager may assign you to prepare food and drink orders (e.g., make coffee or package pastries from the display case), ring up customer orders at the register, or clear and buss tables in the shop and the adjacent reading room. When you were hired, the manager made it abundantly clear that wearing an ISU t-shirt and cap were non-negotiable prerequisites for working there.
- For this exercise, consider the “workers” to be inside the system – i.e., we are analyzing how to design their work processes.

The Coffee Shop

- Who are the stakeholders?
- Who are the actors?
- What events trigger some worker activity?
- Can you list the worker activities?
- What are the system goals associated with each of the various worker activities?