

# CS3773 Software Engineering

## Lecture 04 UML Use Case Modeling

## History of UML

- UML appeared in 1997 after many years of modeling war
  - 1994 Rumbaugh (OMT) joined Booch
  - 1995 Rational bought Objectory  
Jacobson, OOSE -- use cases
  - Rumbaugh, Booch, and Jacobson are known as the "Three Amigos"
  - UML = OMT + Booch + OOSE + ...

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## Introduction

- UML is a set of modeling notations, which include 13 diagrams
  - Static structure of the system  
Class diagram (ERD)  
Object diagram  
... ..
  - Dynamic behavior of the system  
Use case diagram  
Sequence diagram (Event traces)  
State diagram (EFSM)  
... ..

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## Three UML Modes

- Sketch
  - Some aspects of the system
  - For communication purpose
- Blueprint
  - Complete description of the system
  - For designers
- Programming language
  - All details of the system
  - For code generation purpose

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## Object-Oriented Analysis

### Four key steps in OOA

- Define the use cases  
Describe how users interact with the system
- Define the domain model  
Find the objects, classes
- Define the interaction diagrams  
Describe the interaction between the objects
- Define design class diagrams

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## Use Case Modeling

- Use cases are captured in four steps
  - Find a candidate system boundary
  - Find the actors
  - Find the use cases
    - Specify the use case
    - Identify key alternative scenarios
  - Iterate until use cases, actors, and system boundary are stable

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## Actors

- Actors are external to the system
- An actor specifies a role
  - Users that operate the system directly
  - Other software systems or hardware pieces that interact with the system
- One person or thing may play many roles in relation to the system simultaneously or over time
- Actors do not represent specific people or specific things

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## Use Cases

- Use cases are usages of the system
- Use cases capture the functional requirements
  - Use cases provide the high-level descriptions of the system's functionality in terms of interactions
  - Use cases show inputs and outputs between the system and the environment
  - Use cases are from the user's point of view  
Users and other software systems in the environment

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## Use Case - An Example

- > ATM system
  - Withdraw cash
  - Check account balance
  - Maintain usage statistics
  - ...

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## UML Use Case Diagram

- > System: drawn as a box
- > Actors: outside the system
  - Relations among actors
- > Use cases: inside the system
  - Relations among use cases

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## Legend



Actor: an entity in the environment that initiates and interacts with the system



Use case: usage of system  
a set of sequences of actions



Association: relation between actor and use cases



<<include>> Includes dependency: a sub use case

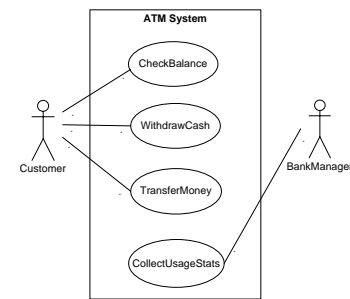


<<extend>> Extends dependency: a sequence of use cases

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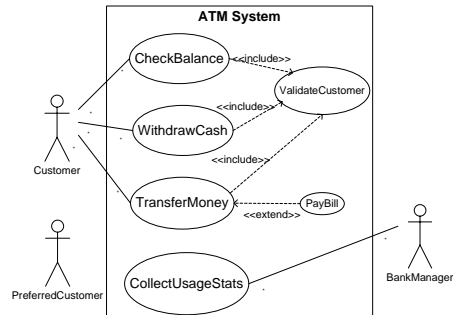
## Use Case Diagram for ATM



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## Use Case Diagram for ATM



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## Process for Identifying Use Cases

- Choose your system boundary
- Identify primary actors
- For each actor, find their goals
- Define a use case for each goal
- Identify the possible variations and error conditions
- Define relationships among actors
- Decompose complex use cases into sub-use cases
- Organize normal alternatives as extension use cases

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## Description of A Use Case

- Give a unique number for referencing UC
- Choose an appropriate name
- Give a brief description
- Associate with the initiating actor, and other actors
- Identify pre-conditions (assumptions)
- Describe the post-condition
- Describe the normal scenario as a sequence of steps
- Identify all possible variations and error conditions for each step

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## Scenario

- A use case is a set of scenarios  
All these scenarios have the same goal
- A scenario is a sequence of interactions between a user and a system

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## Scenario - An Example

Process description for "withdraw cash"

1. User correctly inputs ATM card
2. User enters correct PIN
3. User selects valid account
4. User selects valid amt to withdraw
5. System dispenses cash and receipt
6. System performs accounting
7. User takes card, cash, and receipt

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## Scenario - An Example

Extensions:

- 1a. non-ATM card inserted
- 1b. ATM card incorrectly inserted
- 2a. invalid PIN entered
- ...

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## Review of Use Cases

- Identifying use cases is the first step in OOA
- Use cases are simple and easy to create
- Use cases represent an external view of the system
- Use cases describe both normal scenarios and alternative ones
- All stakeholders understand them

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## Reading Assignments

- UML 2 and The Unified Process
  - Chapter 4
  - Chapter 5

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