G64OOS (Spring 2014)

Lecture 02 (v2)

Object Oriented Analysis

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Motivation for Lecture 02

- Learn what a Use Case is
- Learn what needs to be done before identifying Use Cases
- Learn how to identify Use Cases
- Learn how to create Use Cases
- Learn how to create base and alternative paths for Use Cases

Object Oriented Analysis [Booch et al 2007]

- Analysis
  - Focus is to fully analyse the problem at hand and to model the world by discovering the classes and objects that form the vocabulary of the problem domain

- Design
  - We invent the abstractions and mechanisms in our model that provide the design of the solution to be build

Object Oriented Analysis [Booch et al 2007]

- Proven approaches of analysis relevant to OOS:
  - Classical categorisation approaches
  - Behaviour Analysis
  - Domain Analysis
  - Use Case Analysis
  - CRC Cards
  - Informal English Descriptions
  - Structured Analysis

Object Oriented Analysis [Booch et al 2007]

- Use Case
  - "A behaviourally related sequence of transactions performed by an actor in a dialog with the system to provide some measurable value to the actor"
  - Describes in a formal way how a system will be used
- Use Case Analysis
  - Stakeholders enumerate the scenarios that are fundamental to the system's operation; these collectively describe the system functions of the application
  - Analysis then proceeds by a study of each scenario; as the team walks through each scenario they identify the objects that participate in the scenario, the responsibility of each object, and the ways those objects collaborate with other objects

Object Oriented Analysis [Schneider and Winters 2001]

- Use Cases
  - Used to describe the outwardly visible requirements of a system
  - Used in the requirements analysis phase of a project and contribute to test plans and user guides
  - Used to create and validate a proposed design and to ensure it meets all requirements
- Object Oriented Analysis Overview
  - Conception: Idea + Project Description
  - Risk Analysis
  - Boundary Analysis
  - Actor Identification
  - Use Case Identification

Conception: Idea + Project Description

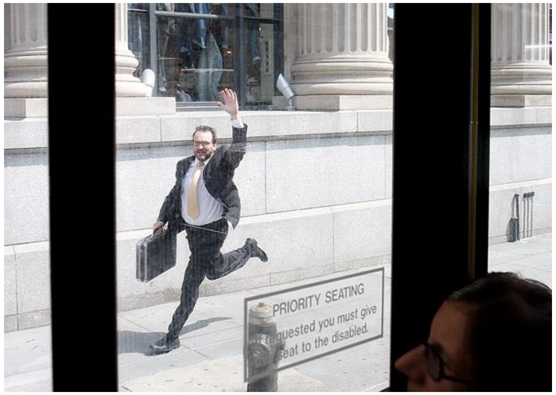
- Every project starts with an idea
  - This idea should be documented and discussed

- Project description
  - Describes how the idea is turned into a product
    - Description should be brief
    - No implementation details
    - Approximate length 1 paragraph – 2 pages
    - Description should be complete!
    - Small group of authors

Case Study

- Idea: "Just in time 4 my bus App"
  - The JIT-bus mobile phone app allows a user to select a bus line from nearby bus stops on a map, and will set an alarm notifying the user when s/he has to leave to catch the next possible bus of the selected line

- Group Task: Project Description
  - Write the corresponding project description



Case Study

- Project description
  - We are developing a mobile phone app that lets people leave just in time to catch their bus: no earlier and no later
  - The app lets the user select a bus line they want to use from a number of nearby bus stops
  - The app sounds an alarm when the user needs to leave
  - The app incorporates live bus location times to make sure the alarm is sounded at the right moment, even if a bus is too late or too fast

Risk Analysis

- Find all relevant market factors:
  - Competition
  - Technologies used
  - Market trends
  - Future trends (e.g. new mobile phones, Galileo system) ...
- Initial risk analysis: What can go wrong?
  - People
  - System
  - Resources
  - Technology
  - Corporate/marketing ...

Case Study

- Group Task: Risk Analysis
  - Make a list of market factors for the JIT-bus app
  - Do a risk analysis for the JIT-bus app

Case Study

- Market factors
  - There already are a number of bus time apps, some of them have the option to pick a line from a map. None have an alarm though.
  - The system depends on the accuracy of bus localisation provided by third party (the bus companies).
  - The system needs users with GPS-enabled smart-phones.
- Risk factors
  - No experience in writing mobile phone apps.
  - Individual differences in time needed to get to bus stop.
  - GPS can’t tell how long it takes to get out of building.
  - Bus times may be very inaccurate.
  - Difficult to advertise apps – no budget.

Boundary Analysis

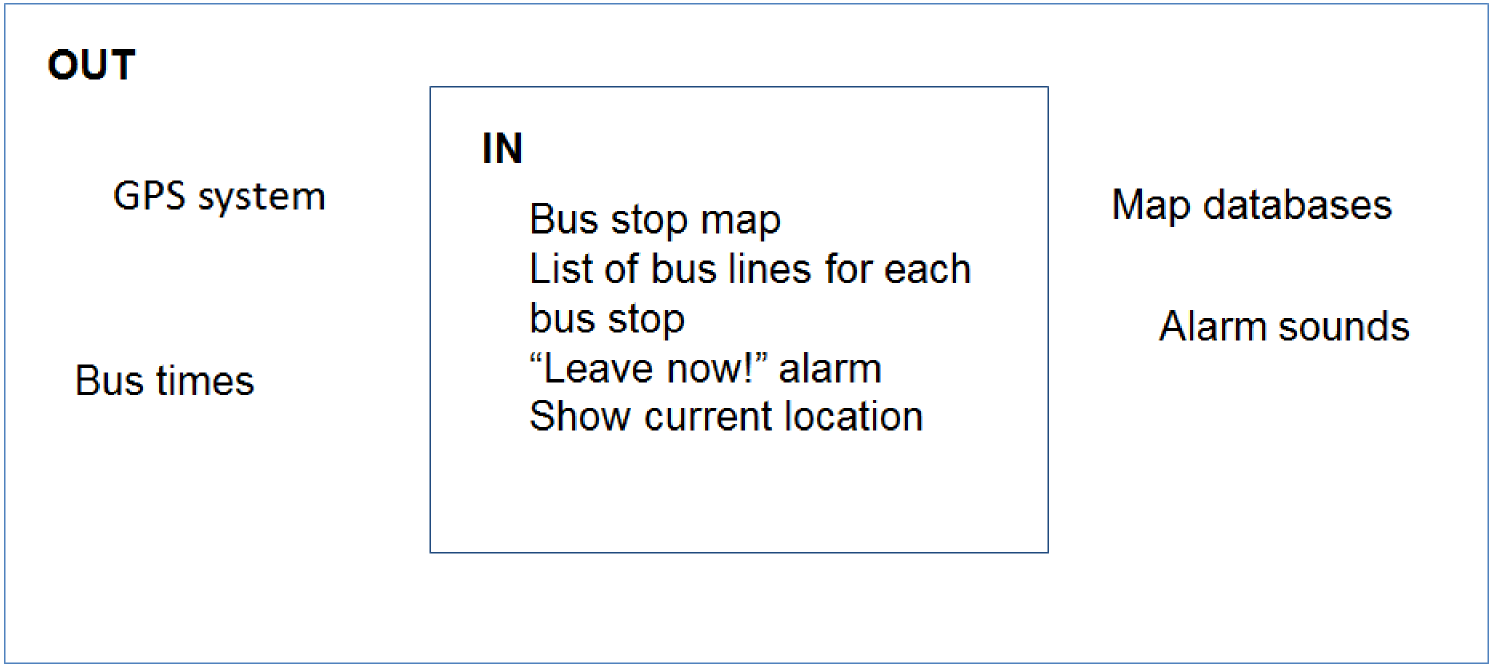
- Boundary Analysis Decisions
  - What services/options are you going to include in your product
  - What services/options will you designate not to be part of your product

Case Study

- Group Task: Boundary Analysis
  - Conduct a Boundary Analysis for the JIT-bus app

Case Study

- Boundary Analysis



OUT

GPS system

Bus times

IN

Bus stop map
List of bus lines for each bus stop
"Leave now!" alarm
Show current location

Map databases

Alarm sounds

Out of scope: Route planner

Actors

- What is an actor?
  - Anyone or anything that acts on the system (people or other software)
  - Actors are always outside of your system
- How to identify actors? Think about the roles the actors play!
  - Who uses the system?
  - Who installs the system?
  - Who starts/stops the system?
  - Who maintains the system?
  - Who gets information from the system?
  - What other systems use the system?

Case Study

- Group Task: Identify Actors
  - Identify the actors in the JIT-bus app

Case Study

- Actors: Anyone that interacts with the system
  - Users
  - Bus Company

- Actors: Anything that interacts with the system
  - GPS System
  - Map Database
  - ...

Break

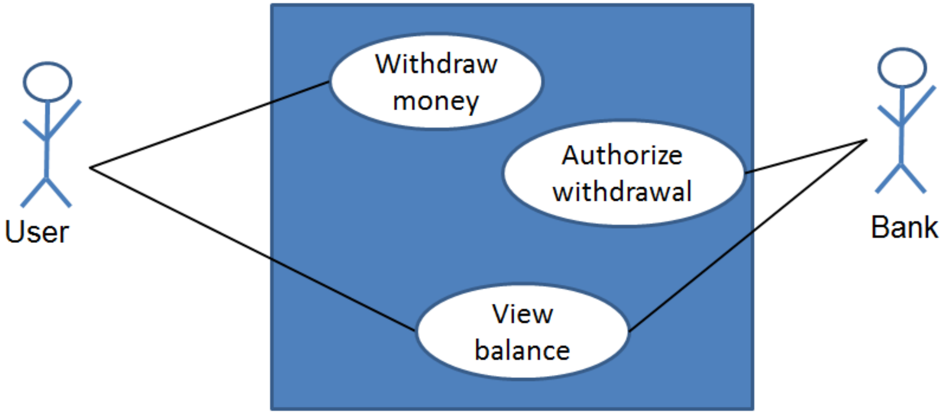
- Have a 10 minute break

Use Cases

- Identifying use cases
  - Use cases represent capabilities
  - Go through all the actors of your system and ask yourself:
    - What functions will the actor want?
    - What information is stored in the system?
    - What actors will create, read, edit or delete this information?
    - Does the system need to notify the actor of internal changes?

Use Case Diagrams

- Use case diagrams
  - Capture the big, compelling objectives
  - Allow us to record and specify the scope of what we are creating
- Example use case diagram in UML
  - Associations indicate which actors initiate which use cases.

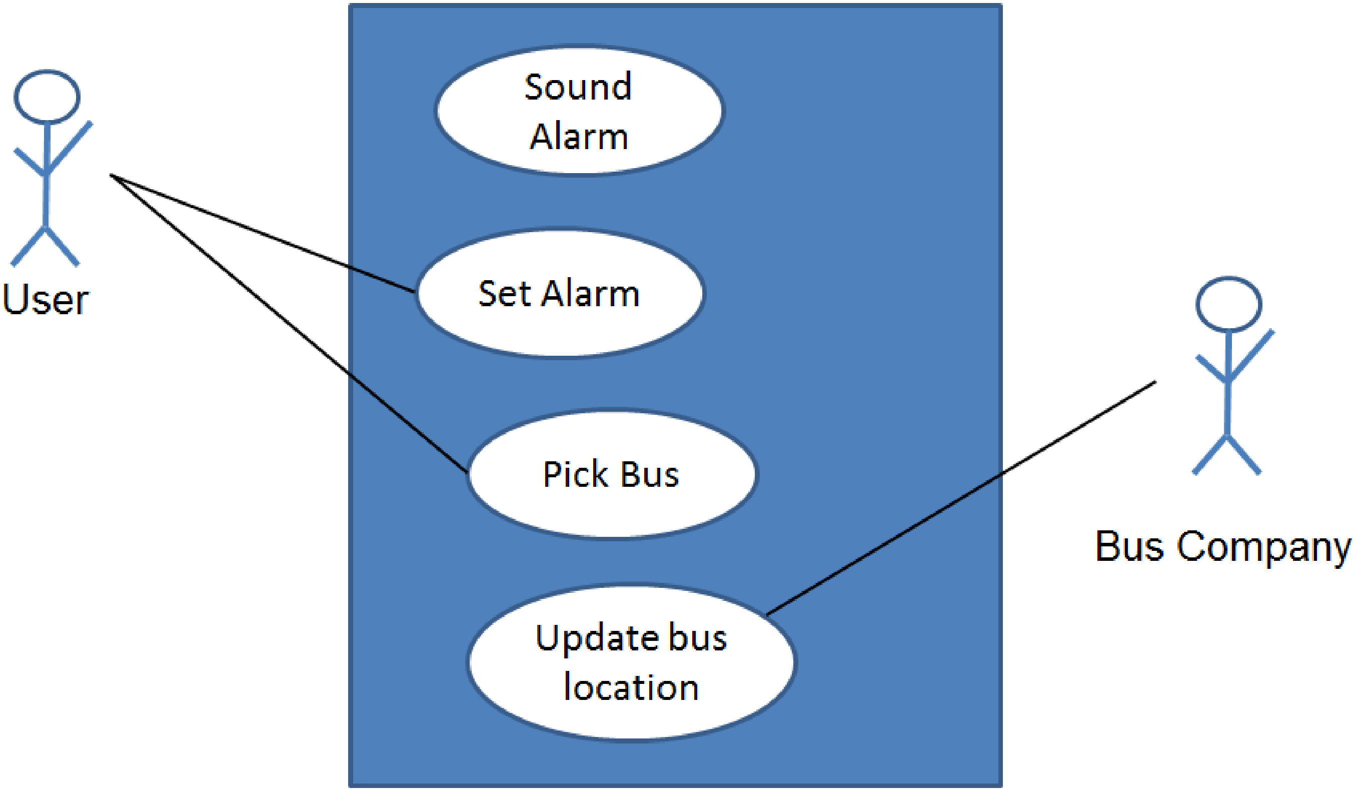


Case Study

- Group Task: Use Case Diagram in UML
  - Draw the use case diagram for the JIT-bus app

Case Study

- Use case diagram in UML

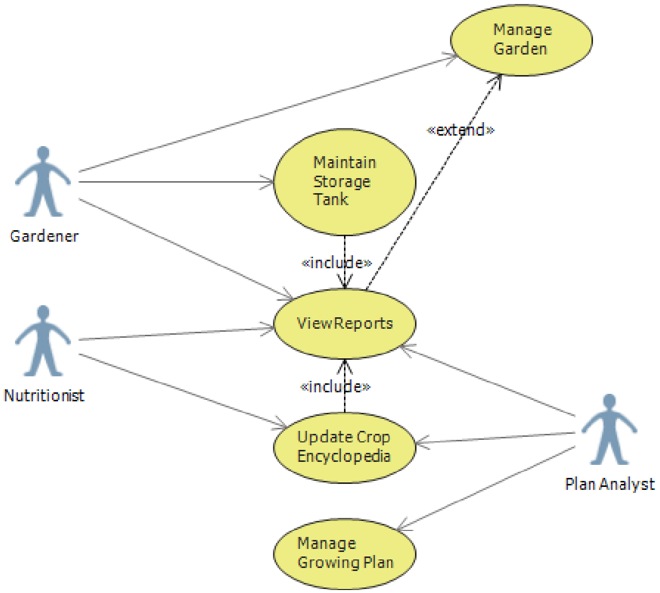


Use Case Diagrams

- Relationships between use cases (often misunderstood)
  - <<include>>
    - Use when one use case is a functionality that another use case requires
    - The dependent use case ultimately re-uses the depended-on use case
  - <<extends>>
    - Use when activities might be performed as part of another activity but are not mandatory for a use case to run successfully
    - We are adding more capability

Use Case Diagrams

- Example use case diagram with <<include>> and <<extend>>
  - The base use case "Maintain Storage Tank" reuses the inclusion use case "View Reports"
  - We are adding more capabilities to the base use case "Manage Garden" by extending it with the extension use case "View Reports"



Use Case Specification

- Use case specification elements
  - Use case name
  - Use case purpose
  - Pre-condition(s)
  - Base Path (optimistic flow)
  - Alternative Paths (pragmatic flows)
  - Post-condition(s)

Use Case Specification

- Example Use Case Specification
  - Use Case Name: Withdraw money
  - Use Case Purpose: This use case provides the ability to withdraw money from an automated teller machine (ATM).
  - Pre-condition(s): ATM is functional and user has an account etc.
  - Base Path:
    1. Actor enters bank card
    2. Actor enters pin
    3. ...
    4. Actor takes money
  - Alternative Path: ….
  - Post-condition(s): Actor has the requested money

Use Case Specification

- Base and alternative path:
  - Base Path (optimistic flow)
    - "happy day" scenario
  - Alternative Paths (pragmatic flows)
    - Every other possible way the system can be (ob)used
    - Includes perfectly normal alternative use, but also errors and failures

Case Study

- Group Task: Use Case Specification
  - Write the base path for the "set alarm" use case

Case Study

- Base path for "set alarm" use case
  - Pre-condition(s): The Use Case begins when the user opens the app
  - Base Path:
    1. The map of the user’s nearest bus stops is loaded
    2. The user selects a bus stop and bus line
    3. The user clicks "OK" button to set alarm
  - Post-condition(s): The alarm is set

Use Case Specification

- Alternative paths
  - How to find them?
    - Going line by line through the base path
    - By exception category: actor exits application; actor cancels operation; actor provides incomplete/bad data; system crashes; …
  - Where to document them?
    - In base description
    - Under base description as separate paragraphs
    - In entirely separate descriptions

Case Study

- Group Task: Use Case Specification
  - Explore what alternative paths there are for the "set alarm" use case
  - Document the most significant alternative path as a paragraph below the base path

Case Study

- Alternate Paths for "set alarm" use case
  - User cancels alarm
  - User changes bus
  - User moves
  - GPS signal lost
  - Connection to bus service lost
  - Connection to internet lost
  - User exits application
  - …

Case Study

- Most significant alternative path for "set alarm" use case
  - Pre-Condition(s): The Use Case begins when the user opens the app
  - Base Path:
    1. The map of the user's nearest bus stops is loaded
    2. The user selects a bus stop and bus line
    3. The user clicks "OK" button to set alarm
  - Alternative Paths:
    - If at any time during step 1 the user moves such that another bus stop is closer the map moves to the new nearest stop, which flashes twice, and a soft sound is played
    - ...
  - Post-Condition(s): The alarm is set

Summary

- What have you learned?

Questions / Comments

References

- Booch et al (2007) Object Oriented Analysis and Design with Applications - 3e
- Jacobsen et al (1994) The Object Advantage: Business Reengineering with Object Technology
- Kimmel (2005) UML Demystified
- Schneider and Winters (2001) Applying Use Cases: A Practical Guide - 2e