Object-Oriented Design

Lecturer: Raman Ramsin

Lecture 4: Use Case Modeling

Part 1

Four Steps of requirements capture

1. List candidate requirements
2. Understand system context
3. ***Capture functional requirements***
4. Capture nonfunctional requirements

Activities of requirements workflow

Capture Functional Requirements

1. ***Find actors and use cases***
2. Prioritize use cases
3. **Detail use cases**
4. Prototype user interface
5. **Structure the use-case model**

Use case modeling

- Use case modeling typically proceeds as follows:
  - Find a candidate system boundary; You generally begin with some initial estimate of where the system boundary lies, to help you scope the modeling activity.
  - Find the actors.
  - Find the use cases:
    - specify the use case;
    - identify key alternative flows.
  - Iterate until use cases, actors, and system boundary are stable.

Use Case Model

- Four components:
  - **System boundary** - a box drawn around the use cases to denote the edge or boundary of the system being modeled. This is known as the *subject* in UML2.
  - **Actors** - roles played by people or things that use the system.
  - **Use cases** - things that the actors can do with the system.
  - **Relationships** - meaningful relationships between actors and use cases.

The subject (system boundary)

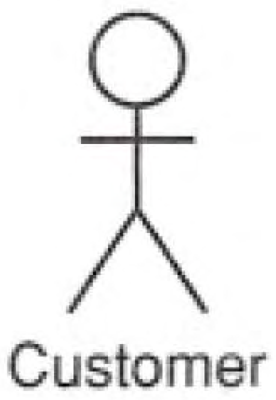
- The subject is defined by who or what uses the system (i.e., the actors) and what specific benefits the system offers to those actors (i.e., the use cases).
- The subject is drawn as a box, labeled with the name of the system
- The actors are drawn *outside* the boundary and the use cases *inside.*
- Use case modeling starts with only a tentative idea of where the subject actually lies.
- As actors and use cases are found, the subject becomes more and more sharply defined.

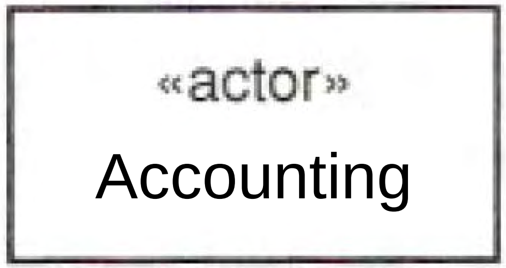
Actors

- An actor specifies a role that some external entity adopts when interacting with the system *directly.*
- It may represent a role played by:
  - a user
  - another system
  - a piece of hardware
- In UML 2, actors may also represent other subjects, giving a way to link different use case models.

Actors: Notation

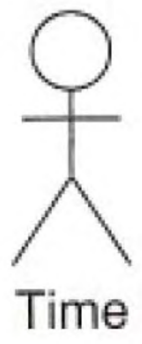
- Can be shown as a class icon stereotyped «actor» or as the "stick man" actor icon.
- “Stick-man" form usually used to represent roles that are likely to be played by people, and the class icon form to represent roles likely to be played by other systems.





Actors: Important Notes

- Although actors themselves are always external to the system, systems often maintain some internal representation of one or more actors.
- *Time as an actor:*
  - When you need to model things that happen to your system at a specific point in time but which *don't* seem to be triggered by any actor; e.g. an automatic system backup that runs every evening.



Identifying Actors

- Need to consider who or what uses the system, and what roles they play in their interactions with the system.
- Asking the following questions helps identify actors:
  - Who or what uses the system?
  - What roles do they play in the interaction?
  - Who installs the system?
  - Who or what starts and shuts down the system?
  - Who maintains the system?
  - What other systems interact with this system?
  - Who or what gets and provides information to the system?
  - Does anything happen at a fixed time?

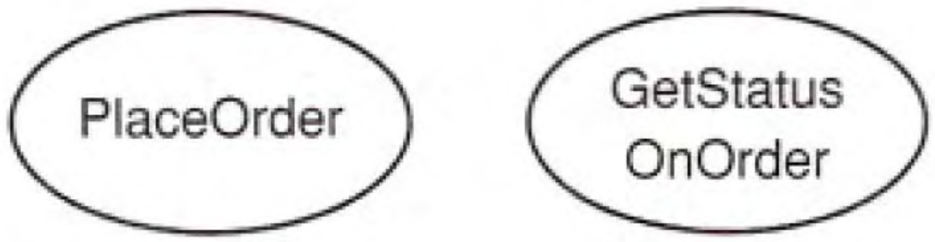
Actors: Specification

- Each actor needs a short name that makes sense from the business perspective.
- Each actor must have a short description (one or two lines) that describes what this actor is from a business perspective.

Actor name: Order Processing Clerk
Description: The Order Processing Clerk is responsible for processing sales orders, submitting reorder requests, requesting necessary deposits from members and scheduling the delivery of the goods to members.

Use Case

- "A specification of sequences of actions, including variant sequences and error sequences, that a system, subsystem or class can perform by interacting with outside actors."
- *Always* started by an actor.
- *Always* written from the point of view of the actors.



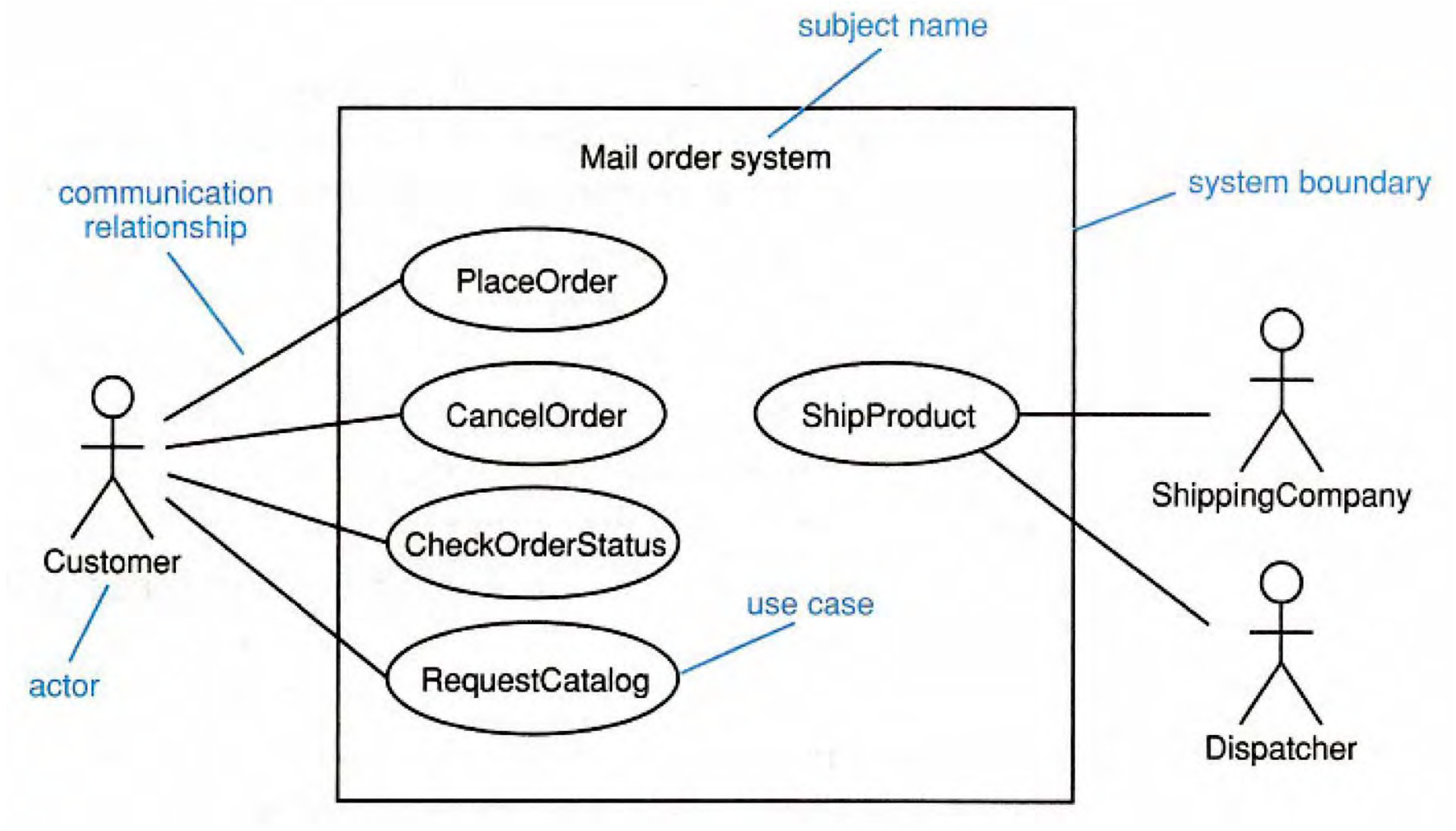
Identifying Use Cases

- The best way of identifying use cases is to start with the list of actors, and then consider how each actor is going to use the system.
- Each use case must be given a short, descriptive name that is a verb phrase.
- Identifying use cases may also result in finding new actors.

Identifying Use Cases: Helpful Questions

- The following list of questions helps identify the use cases:
  - What functions will a specific actor want from the system?
  - Does the system store and retrieve information? If so, which actors trigger this behavior?
  - What happens when the system changes state (e.g., system start and stop)? Are any actors notified?
  - Do any external events affect the system? What notifies the system about those events?
  - Does the system interact with any external system?
  - Does the system generate any reports?

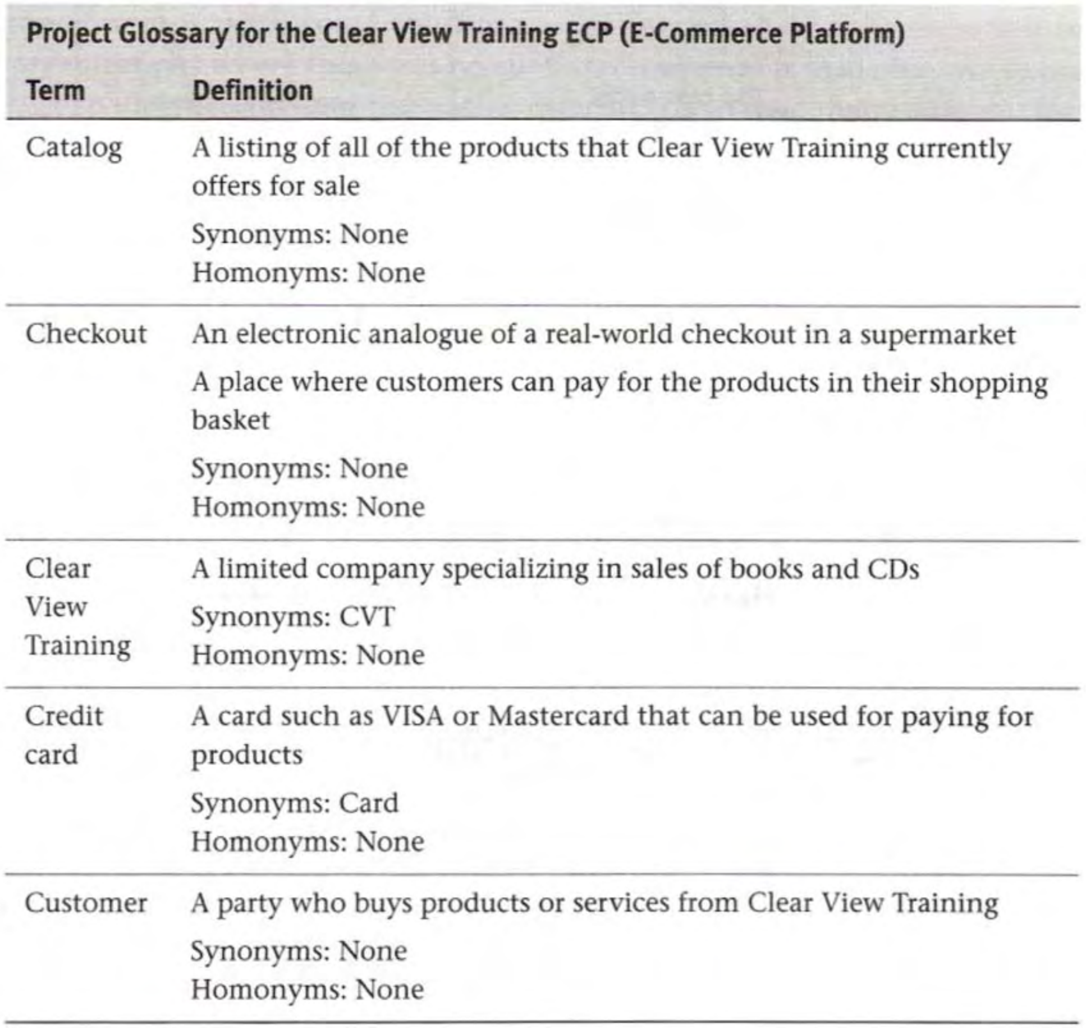
Use Case Diagram



Project Glossary

- The glossary provides a dictionary of key business terms and definitions.
- It should be understandable by everyone in the project, including all the stakeholders.
- As well as defining key terms, the project glossary must resolve synonyms and homonyms.

Project Glossary: Example



Project Glossary for the Clear View Training ECP (E-Commerce Platform)

Term	Definition
Catalog	A listing of all of the products that Clear View Training currently offers for sale Synonyms: None Homonyms: None
Checkout	An electronic analogue of a real-world checkout in a supermarket A place where customers can pay for the products in their shopping basket Synonyms: None Homonyms: None
Clear View Training	A limited company specializing in sales of books and CDs Synonyms: CVT Homonyms: None
Credit card	A card such as VISA or Mastercard that can be used for paying for products Synonyms: Card Homonyms: None
Customer	A party who buys products or services from Clear View Training Synonyms: None Homonyms: None

Activities of requirements workflow

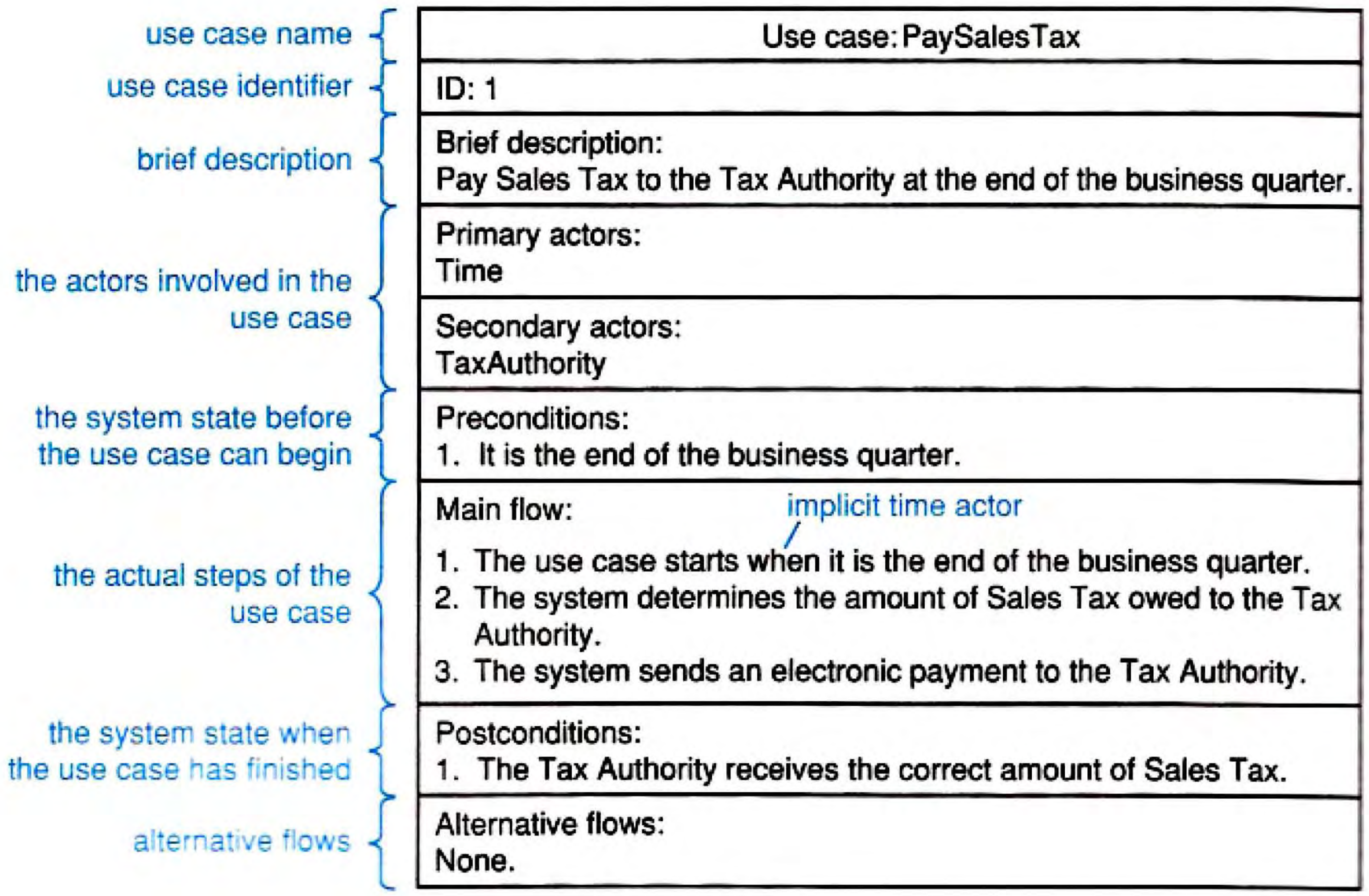
Capture Functional Requirements

1. **Find actors and use cases**
2. Prioritize use cases
3. ***Detail use cases***
4. Prototype user interface
5. **Structure the use-case model**

Use Case Specification: Template

- use case name - short, descriptive verb phrase in UpperCamelCase;
- use case ID - alternative routes are specified by using Dewey-decimal numbering;
- brief description - a paragraph that captures the goal of the use case;
- actors involved in the use case;
  - primary actors - actually trigger the use case;
  - secondary actors - interact with the use case after it has been triggered.
- preconditions - these are things that must be true before the use case can execute - they are constraints on the state of the system;
- main flow - the steps in the use case;
- postconditions - things that must be true at the end of the use case;
- alternative flows - a list of alternatives to the main flow.

Use Case Specification: Example

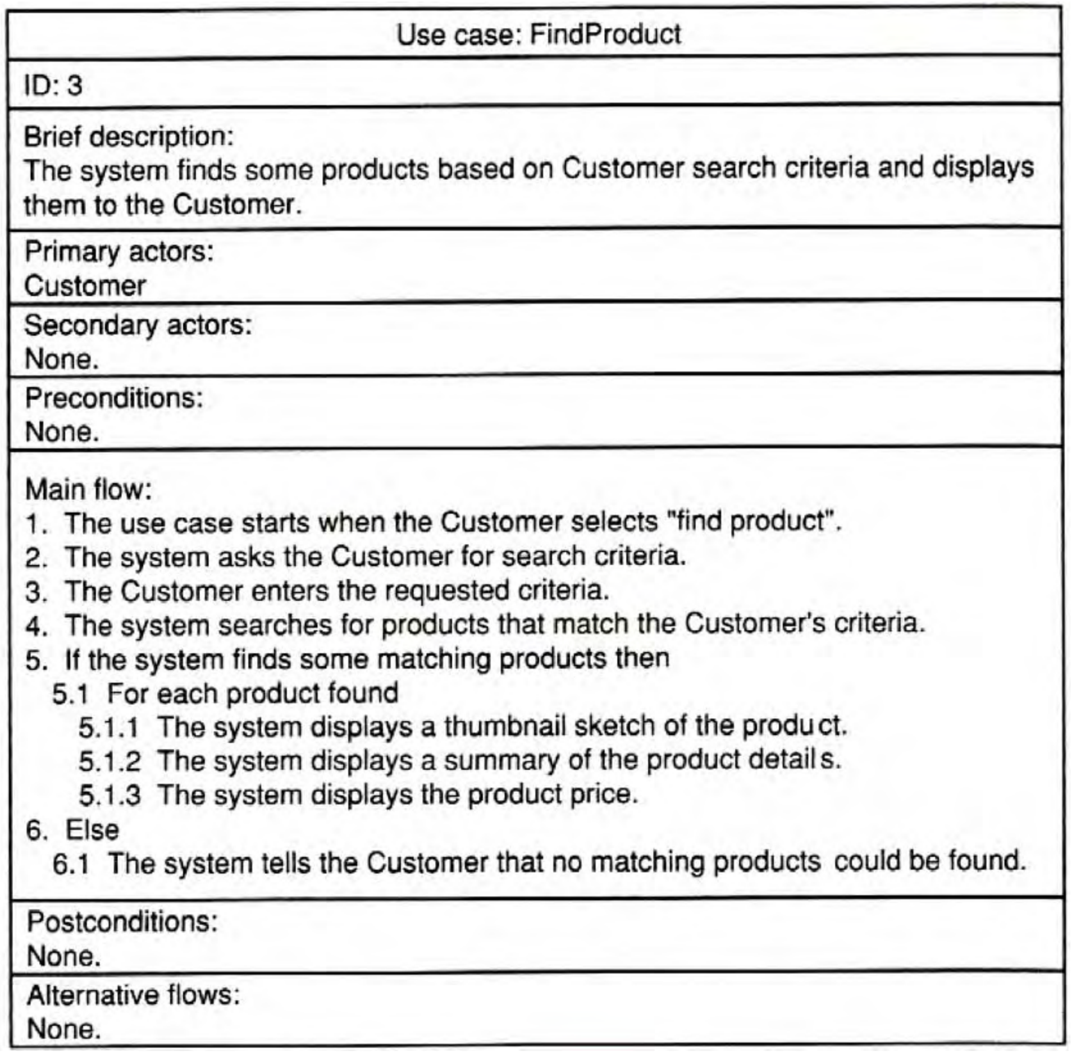

use case name
use case identifier
brief description
the actors involved in the use case
the system state before the use case can begin
the actual steps of the use case
the system state when the use case has finished
alternative flows
implicit time actor

Use case: PaySalesTax
ID: 1
Brief description: Pay Sales Tax to the Tax Authority at the end of the business quarter.
Primary actors: Time
Secondary actors: TaxAuthority
Preconditions: 1. It is the end of the business quarter.
Main flow: 1. The use case starts when it is the end of the business quarter. 2. The system determines the amount of Sales Tax owed to the Tax Authority. 3. The system sends an electronic payment to the Tax Authority.
Postconditions: 1. The Tax Authority receives the correct amount of Sales Tax.
Alternative flows: None.

Use Case: Flows

- The steps in a use case are listed in flows of events, described in structured language.
- Every use case has one *main flow (Primary Scenario),* which lists the steps in a use case that capture the situation where everything goes as expected and desired, and there are no errors, deviations, interrupts, or branches.
- *Alternative flows (Secondary Scenarios)* are deviations from the main flow, and can capture errors, branches, and interrupts to the main flow.
- The main flow *always* begins by the primary actor doing something to trigger the use case. Time can be an actor, so the use case may also start with a time expression in place of the actor.

Use Case: Flow Description



Use case: FindProduct

ID: 3

Brief description:
The system finds some products based on Customer search criteria and displays them to the Customer.

Primary actors:
Customer

Secondary actors:
None.

Preconditions:
None.

Main flow:
1. The use case starts when the Customer selects "find product".
2. The system asks the Customer for search criteria.
3. The Customer enters the requested criteria.
4. The system searches for products that match the Customer's criteria.
5. If the system finds some matching products then
   - 5.1 For each product found
     - 5.1.1 The system displays a thumbnail sketch of the product.
     - 5.1.2 The system displays a summary of the product details.
     - 5.1.3 The system displays the product price.
6. Else
   - 6.1 The system tells the Customer that no matching products could be found.

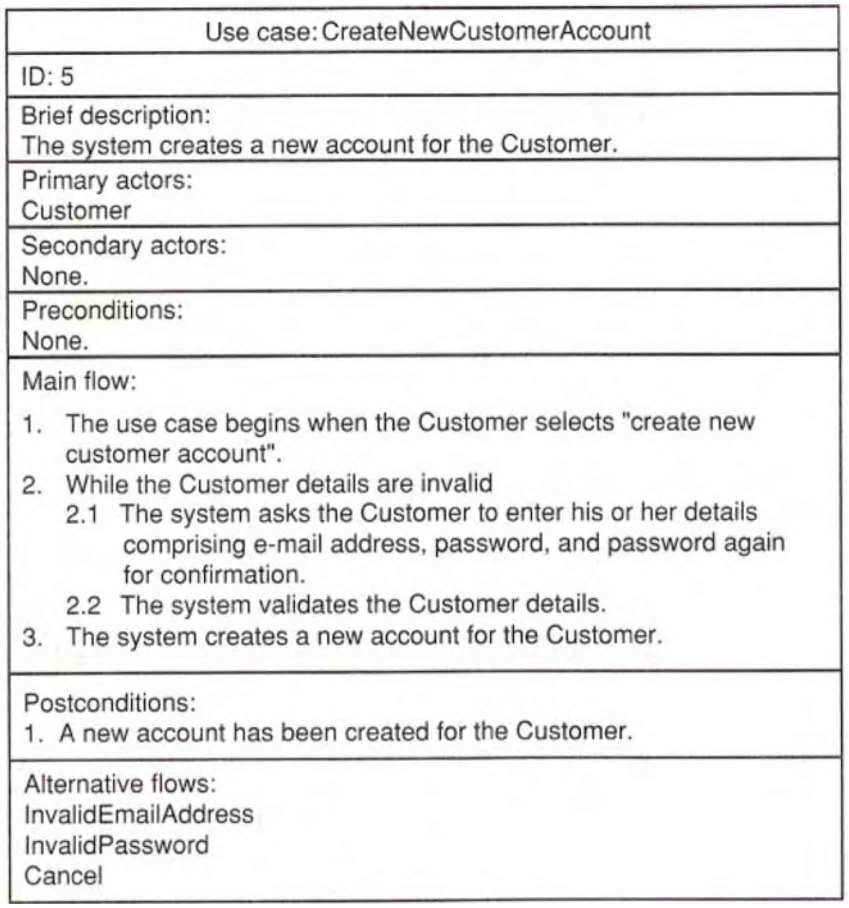
Postconditions:
None.

Alternative flows:
None.

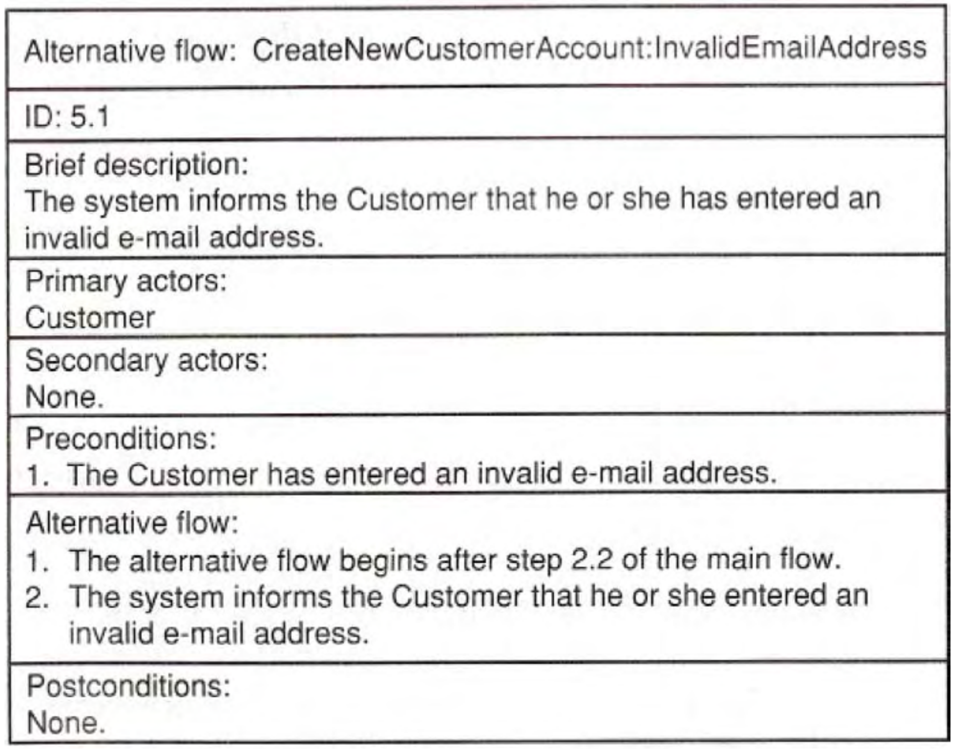
Use Case: Alternative Flows

- Frequently do not return to the main flow; because they often deal with errors and exceptions to the main flow and tend to have different postconditions.
- Should preferably be documented separately.
- May be triggered in three different ways, which should be stated in their flow descriptions:
  - *instead of* the main flow: triggered by the primary actor, it effectively replaces the use case entirely.
  - *after a particular step* in the main flow
  - *at any time* during the main flow

Use Case: Alternative Flow Example



Use case: CreateNewCustomerAccount
ID: 5
Brief description: The system creates a new account for the Customer.
Primary actors: Customer
Secondary actors: None.
Preconditions: None.
Main flow: 1. The use case begins when the Customer selects "create new customer account". 2. While the Customer details are invalid 2.1 The system asks the Customer to enter his or her details comprising e-mail address, password, and password again for confirmation. 2.2 The system validates the Customer details. 3. The system creates a new account for the Customer.
Postconditions: 1. A new account has been created for the Customer.
Alternative flows: InvalidEmailAddress InvalidPassword Cancel



Alternative flow: CreateNewCustomerAccount:InvalidEmailAddress
ID: 5.1
Brief description: The system informs the Customer that he or she has entered an invalid e-mail address.
Primary actors: Customer
Secondary actors: None.
Preconditions: 1. The Customer has entered an invalid e-mail address.
Alternative flow: 1. The alternative flow begins after step 2.2 of the main flow. 2. The system informs the Customer that he or she entered an invalid e-mail address.
Postconditions: None.

Use Case: Finding Alternative Flows

- Identify alternative flows by inspecting the main flow. At each step in the main flow, look for:
  - possible alternatives to the main flow;
  - errors that might be raised in the main flow;
  - interrupts that might occur at a particular point in the main flow;
  - interrupts that might occur at *any* point in the main flow.

Reference

- Arlow, J., Neustadt, I., *UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design*, 2nd Ed. Addison-Wesley, 2005.