4. Business Process Identification with Use Case Modelling

IT 3106– Object Oriented Analysis and Design

Level II - Semester 3

Overview

In this section, students will be introduced to

- Use Case Modeling with their benefits.
- Components of a Use Case Diagram, and steps involved in drawing the diagram.
- The elements of a Use Case description.

Intended Learning Outcomes

At the end of this lesson students will be able to

- describe the benefits of Use-Case Modeling
- define actors, use cases and use-case relationships
- identify and describe the steps for preparing a use-case model

List of Subtopics

4. Business Process Identification with Use Case Modelling (5 hours)

4.1 Introduction to Use-Case Modeling [Ref 1: Pg. 119-121]

4.2 Elements of a Use Case Diagram [Ref 1: Pg. 121-126]

- 4.2.1 Actors
- 4.2.2 Use Cases
- 4.2.3 Use Case Relationships

4.3 Creating a Use Case Diagram [Ref 1: Pg. 126-129]

4.4 Business Process Documentation with Use Cases and Use-Case Descriptions [Ref 1: Pg. 140-152]

- 4.4.1 Elements of a Use-Case Description
- 4.4.2. Creating Use-case Descriptions

Ref 1: Alan Dennis, Barbara Haley, David Tegarden, Systems analysis design, An Object Oriented Approach with UML : an object oriented approach, 5th edition, John Wiley & Sons, 2015, ISBN 978-1-118-80467-4

4.1 Introduction to Use-Case Modeling

- Originally conceived by Dr. Ivar Jacobson in 1986.
- Proved to be a valuable aid in meeting the challenges of determining what a system is required to do from a user and stakeholder perspective.
- A best practice for defining, documenting and understanding of an information system's functional requirements.

4.1 Introduction to Use-Case Modeling

- All object-oriented systems development approaches are use-case driven, architecture-centric, and iterative and incremental.
- A use case is a formal way of representing the way a business system interacts with its environment.
- Essentially, a use case is a high-level overview of the business processes in a business information system.
- Use cases can document the current system or the new system being developed.
- Given that object-oriented systems are use-case driven, use cases also form the foundation for testing and for user-interface design.

4.1 Introduction to Use-Case Modeling

- It is the process of modeling a system's functions in terms of
  - business events
  - who initiated the events
  - how the system responds to those events
- An approach that facilitates user-centered development - a process of systems development based on understanding the needs of the stakeholders and the reasons why the system should be developed

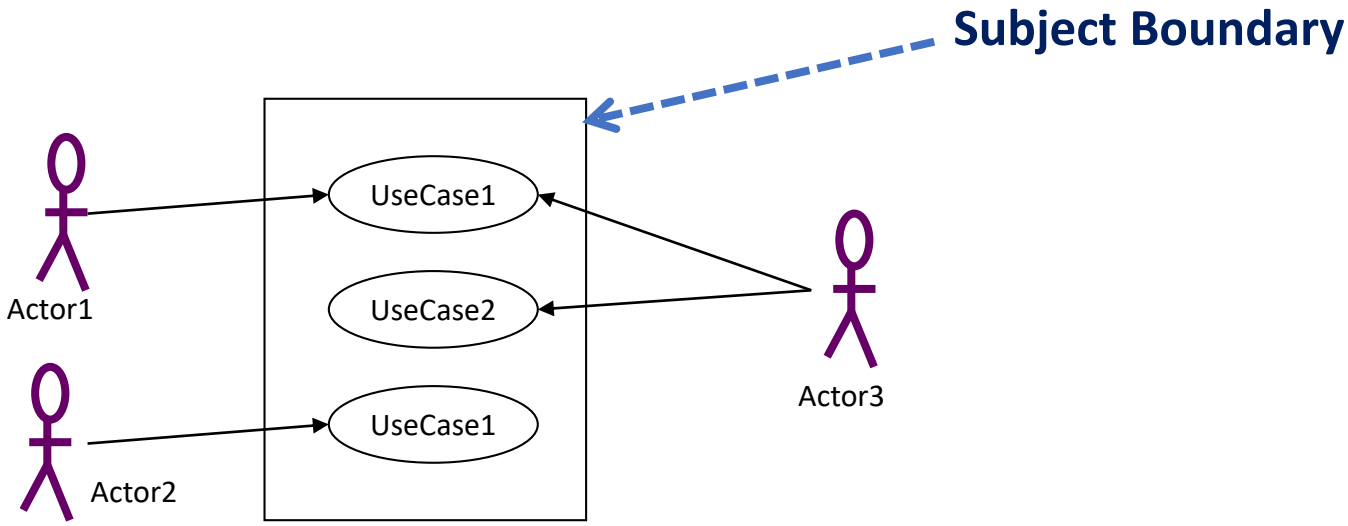
4.1 Introduction to Use-Case Modeling

- Popular in non-object development environments because of its usefulness in communicating with users.
- Facilitates and encourages user involvement
- Provides a tool for capturing functional requirements
- Provides a tool for requirements traceability
- Provides a framework for driving the system development project

4.1 Introduction to Use-Case Modeling

Use-case diagram

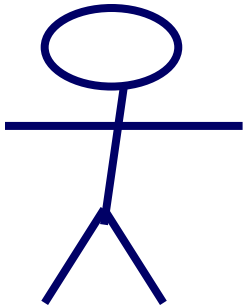
- Depicts the interactions between the **system** and **external systems / users.**
- Graphically describes ***who will use the system*** *and* ***in what ways the user expects to interact with the system***
- A ***Subject Boundary*** represents the scope of the subject



4.2 Elements of a Use Case Diagram

Actor

- Anyone or anything that needs to interact with the system to exchange information.
- Represented graphically as a stick figure labeled with the name of the role the actor plays.
- Can be associated with other actors using a specialization/superclass association, (see later)
- Is placed outside the subject boundary.



4.2 Elements of a Use Case Diagram

Actor

- An Actor may
  - Only input information to the system.
  - Only receive information from the system.
  - Input and receive information to and from the system.

- Typically, they are found in the problem statement and by conversations with customers and domain experts.

e.g. Librarian in a Library System

Grocery clerk in a Super Market

4.2 Elements of a Use Case Diagram

Actors :

There are primarily four types of Actors.

- Primary Business Actor
- Primary System Actor
- External Server Actor
- External Receiver Actor

4.2 Elements of a Use Case Diagram

Types of Actors

- **Primary Business Actors** – Benefits from the execution of use cases by receiving some thing measurable.

  e.g. Employee receiving a pay cheque.

- **Primary System Actors** - Directly Interfaces with the system to trigger an event.

  e.g. Grocery Clerk – Scan customer buying Items .

4.2 Elements of a Use Case Diagram

Types of Actors cont…

- External Server Actor

  e.g. Credit bureau authorizing the charging by a credit card.

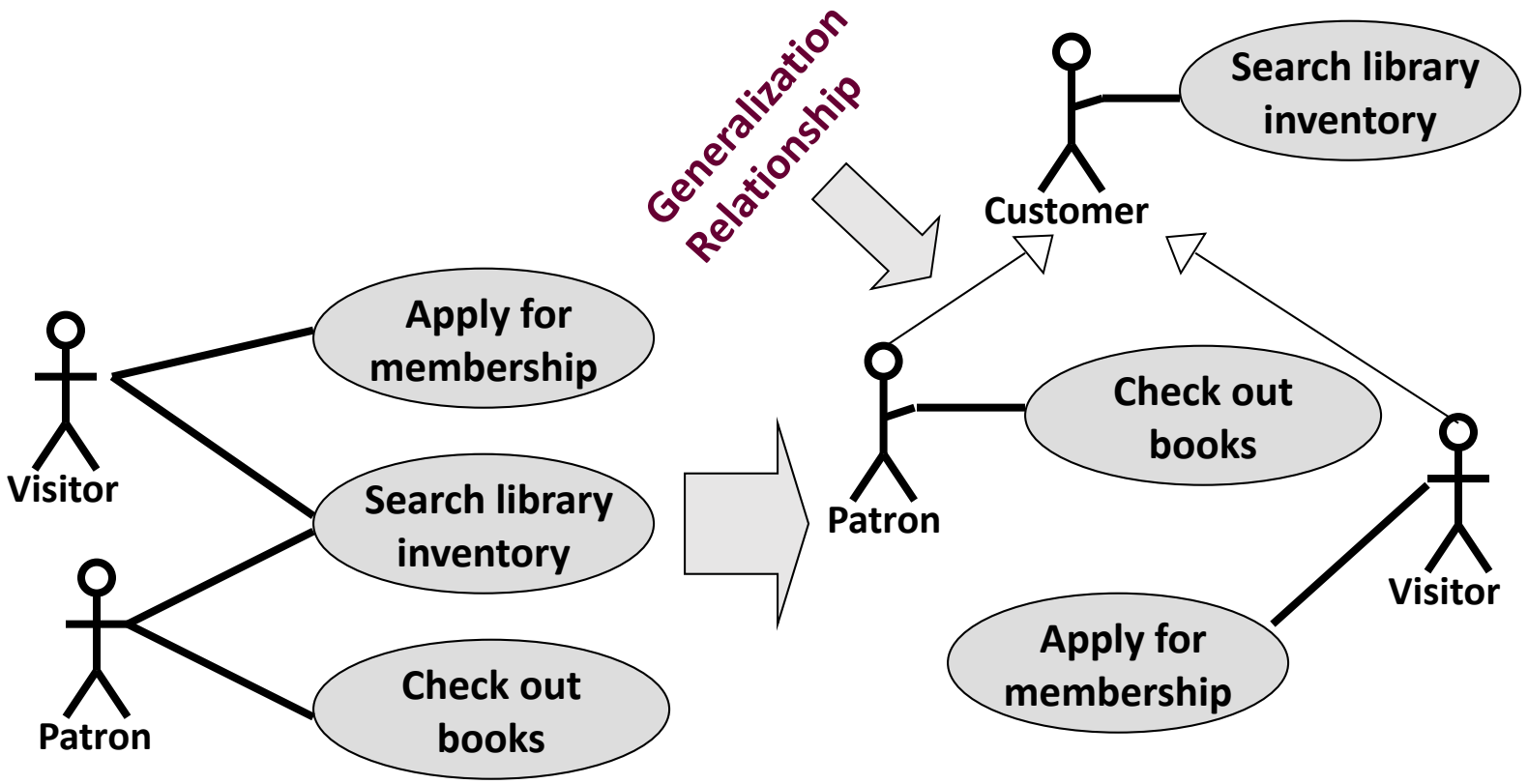
- External Receiver Actor

  e.g. Warehouse receiving a package order to prepare a shipment.

4.2 Elements of a Use Case Diagram

Actor Generalization

It factors out behaviour common to two or more actors into a parent actor



4.2 Elements of a Use Case Diagram

Use Case

- A behaviorally related sequence of steps both automated and manual for the purpose of completing a single business task.
- Describe system functions from the perspective of external users in a manner they understand.
- They are the primary elements in software development.
- They represent the functionality provided by the system. i.e. what capabilities will be provided to an actor by the system.

4.2 Elements of a Use Case Diagram

Use Case

- Can extend another use case. (see later)
- Can include another use case. (see later)
- Is placed inside the system boundary.
- Is labeled with a descriptive verb–noun phrase.

4.2 Elements of a Use Case Diagram

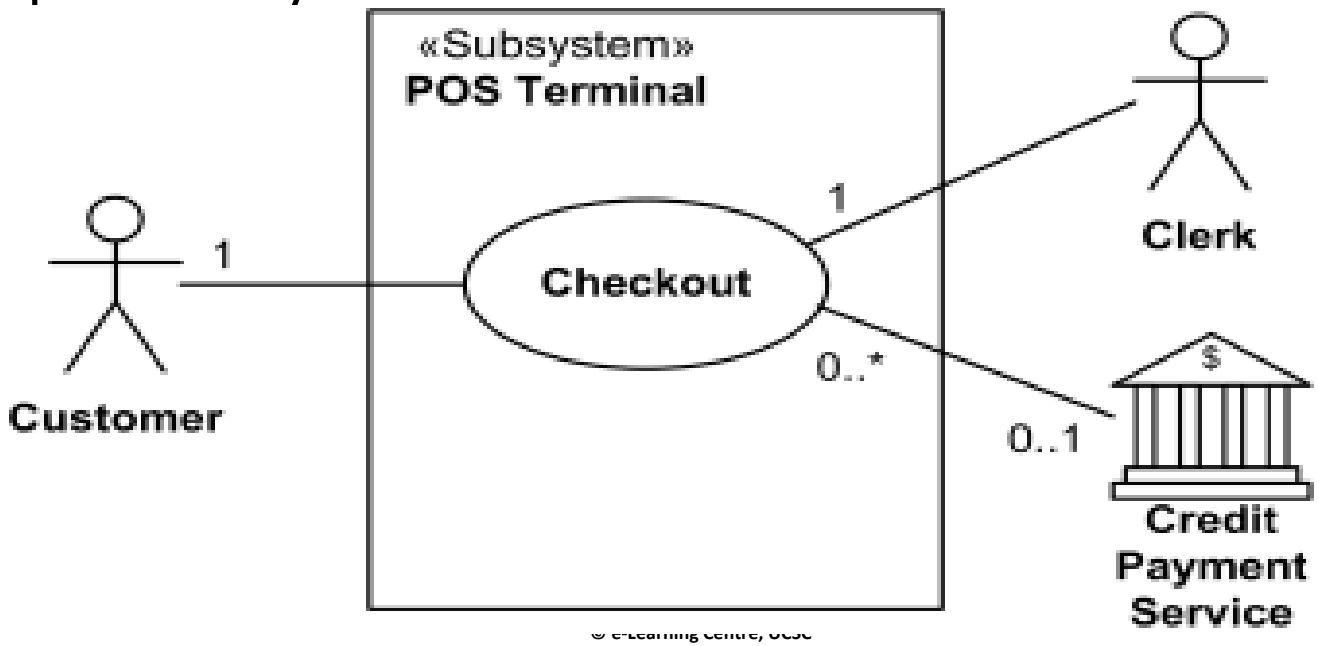
Relationships

- Associations (also called <<Communicates>>)
  - A relationship between an actor and a use case in which an interaction occurs between them
  - Modeled as a solid line connecting the actor and the use case
  - May be bidirectional or unidirectional
  - UML 2.5 allows multiplicity

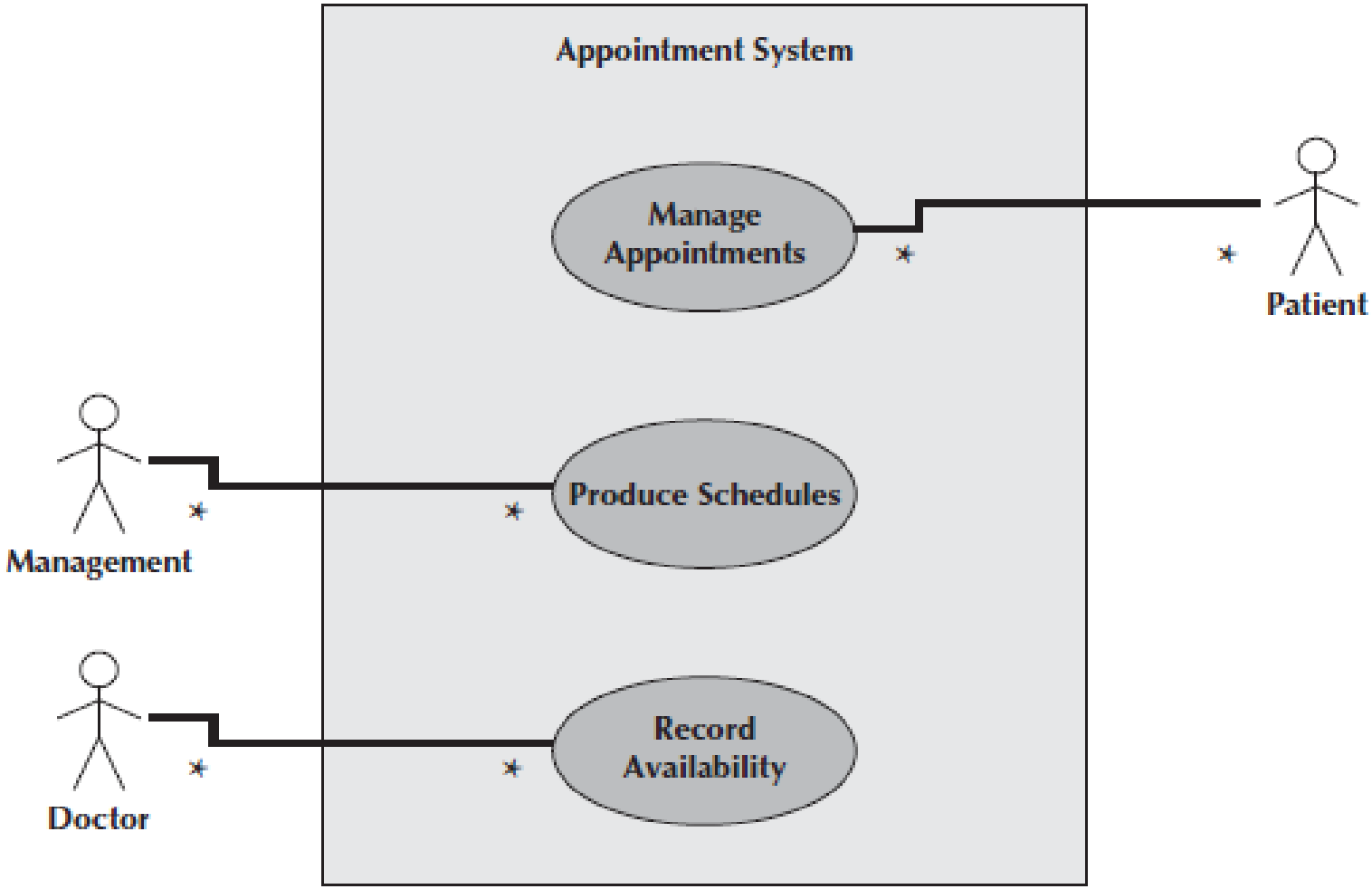
4.2 Elements of a Use Case Diagram

Multiplicity of an Actor/Use Case (UML 2.5)

- Required actor may be explicitly denoted using multiplicity 1 or greater.
- UML 2.5 also allows actor to be optional.
- Multiplicity 0..1 of actor means that the actor may or may not participate in any of their associated use cases.



4.2 Elements of a Use Case Diagram

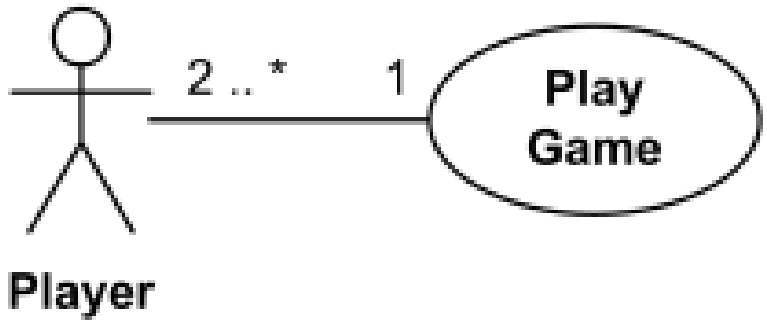


Use Case Diagram for an appointment system

4.2 Elements of a Use Case Diagram

Multiplicity of an Actor / Use Case (UML 2.5)

- When a use case has an association to an actor with a multiplicity that is greater than one at the actor end, it means that more than one actor instance is involved in the use case.



Two or more Player actors are involved in the Play Game use case.
Each Player participates in one Play Game.

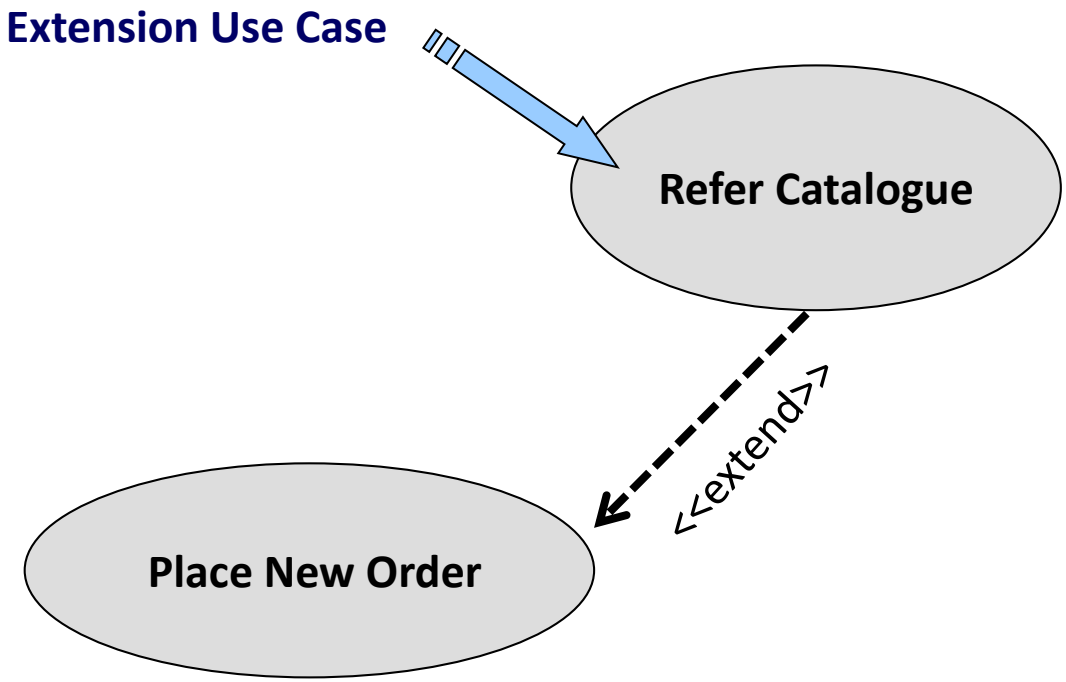
4.2 Elements of a Use Case Diagram

Relationships

- Extend **<<extend>>**
  - <<extend>> provides a way to insert new behaviour into an existing use case.
  - The extension use case extends the functionality of the original use case.
  - Shows optional behavior of a Use Case
  - Depicted as an arrow headed line (either solid / dashed)
  - Has an arrow drawn from the extension use case to the base use case.

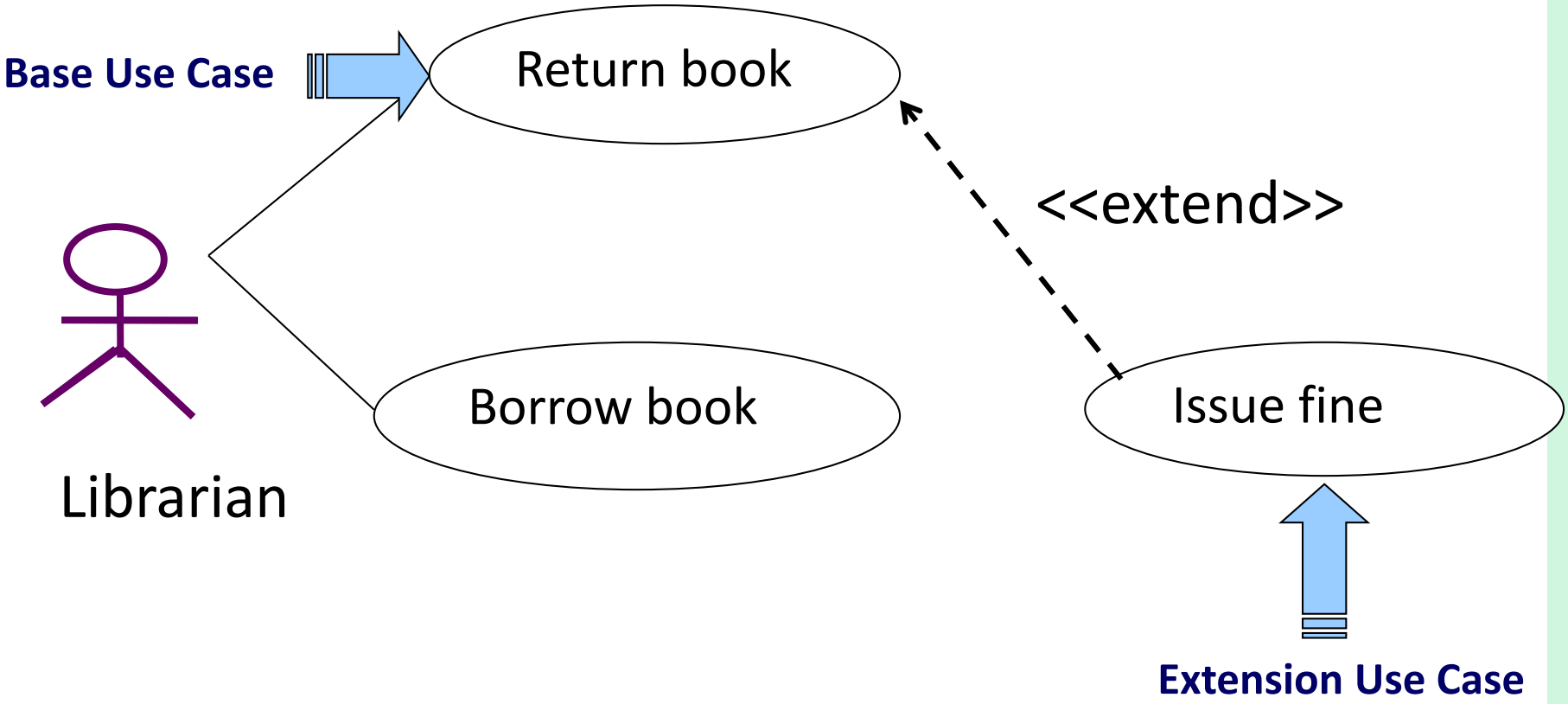
4.2 Elements of a Use Case Diagram

Example: Extend Relationships



4.2 Elements of a Use Case Diagram

Another Example for Extend Relationships



4.2 Elements of a Use Case Diagram

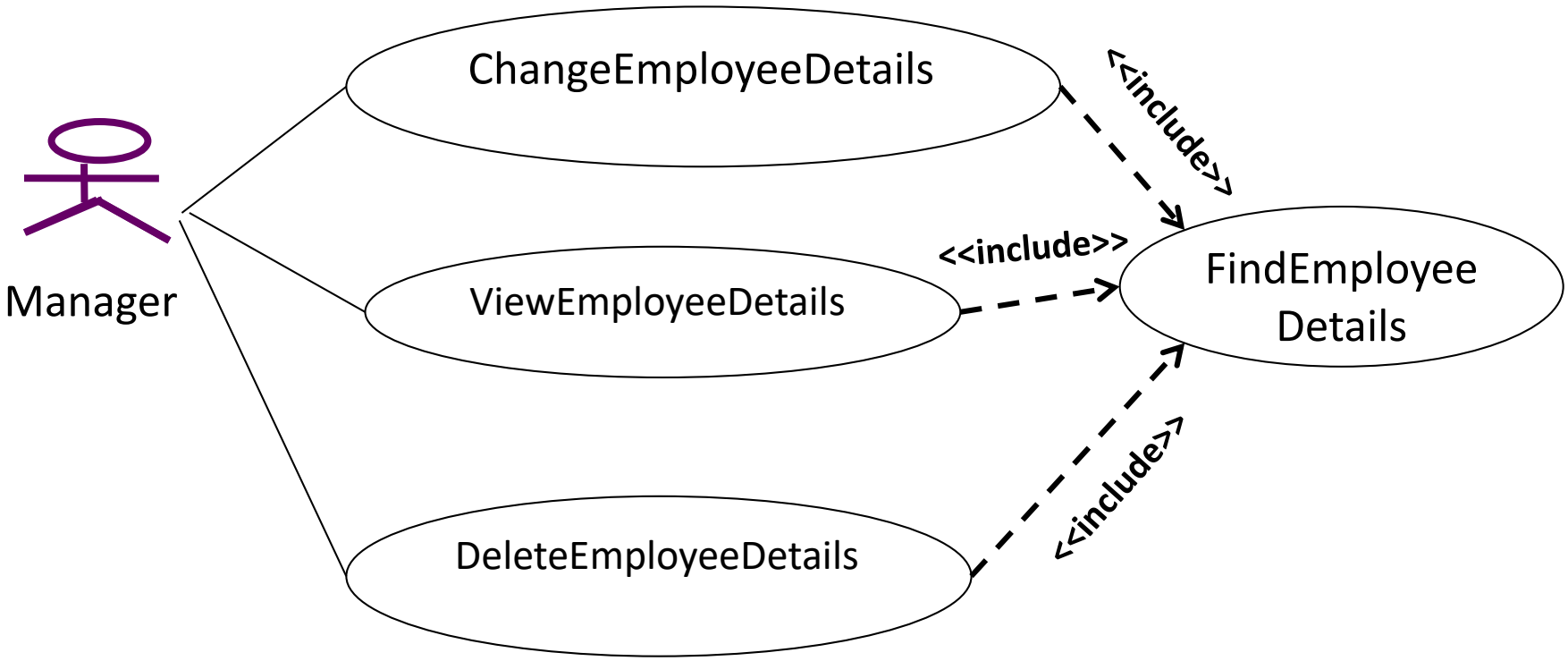
Relationships

- **Include** **<<include>>**
  - The base use case explicitly incorporates the behavior of another use case.
  - The relationship between the abstract use case and use case that uses it.

4.2 Elements of a Use Case Diagram

Relationships

- **include**
  - Another use case uses or ***includes*** the abstract use case.



4.2 Elements of a Use Case Diagram

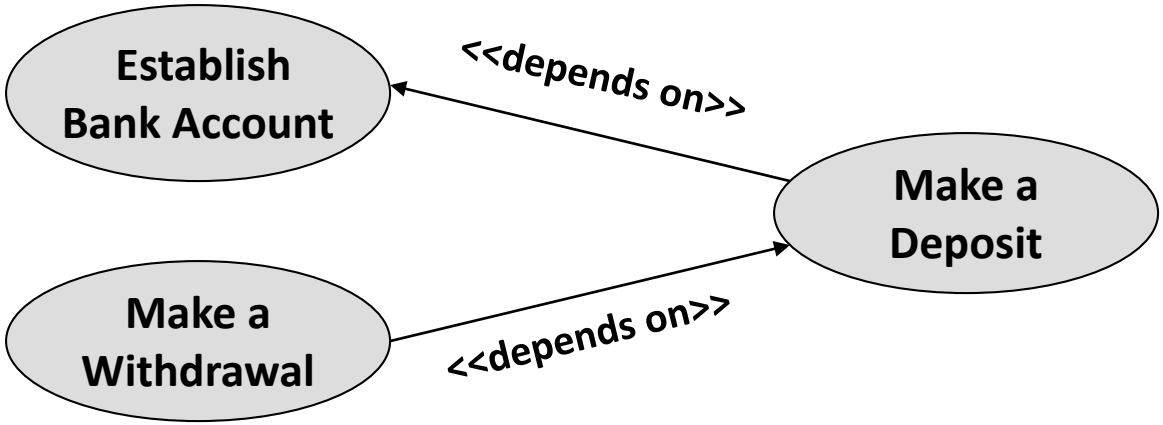
Relationships

- Depends on **<<depends on>>**
  - A relationship between use cases indicating that one use case cannot be performed until another use case has been performed.
    - e. g. banking business – use case ‘ Make a Withdrawal’ cannot be performed until the use case ‘Make a Deposit’ has been executed.
  - Most analysts draw a separate diagram to show dependency relationship.

4.2 Elements of a Use Case Diagram

Relationships

- **Depends on**



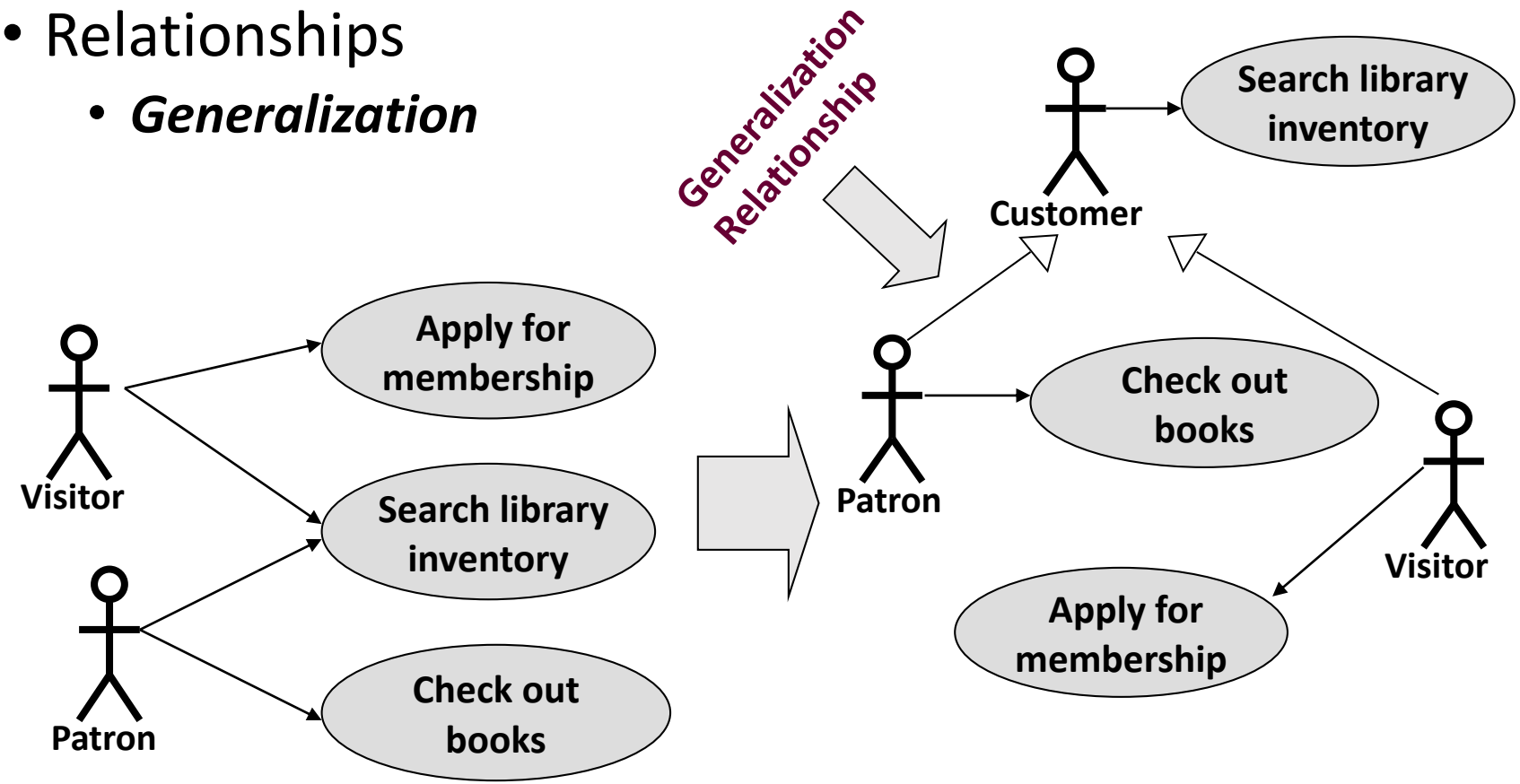
4.2 Elements of a Use Case Diagram

Relationships

- Relationships
  - Generalization
    - A relationship between actors created to simplify the drawing when an abstract actor inherits the role of multiple real actors

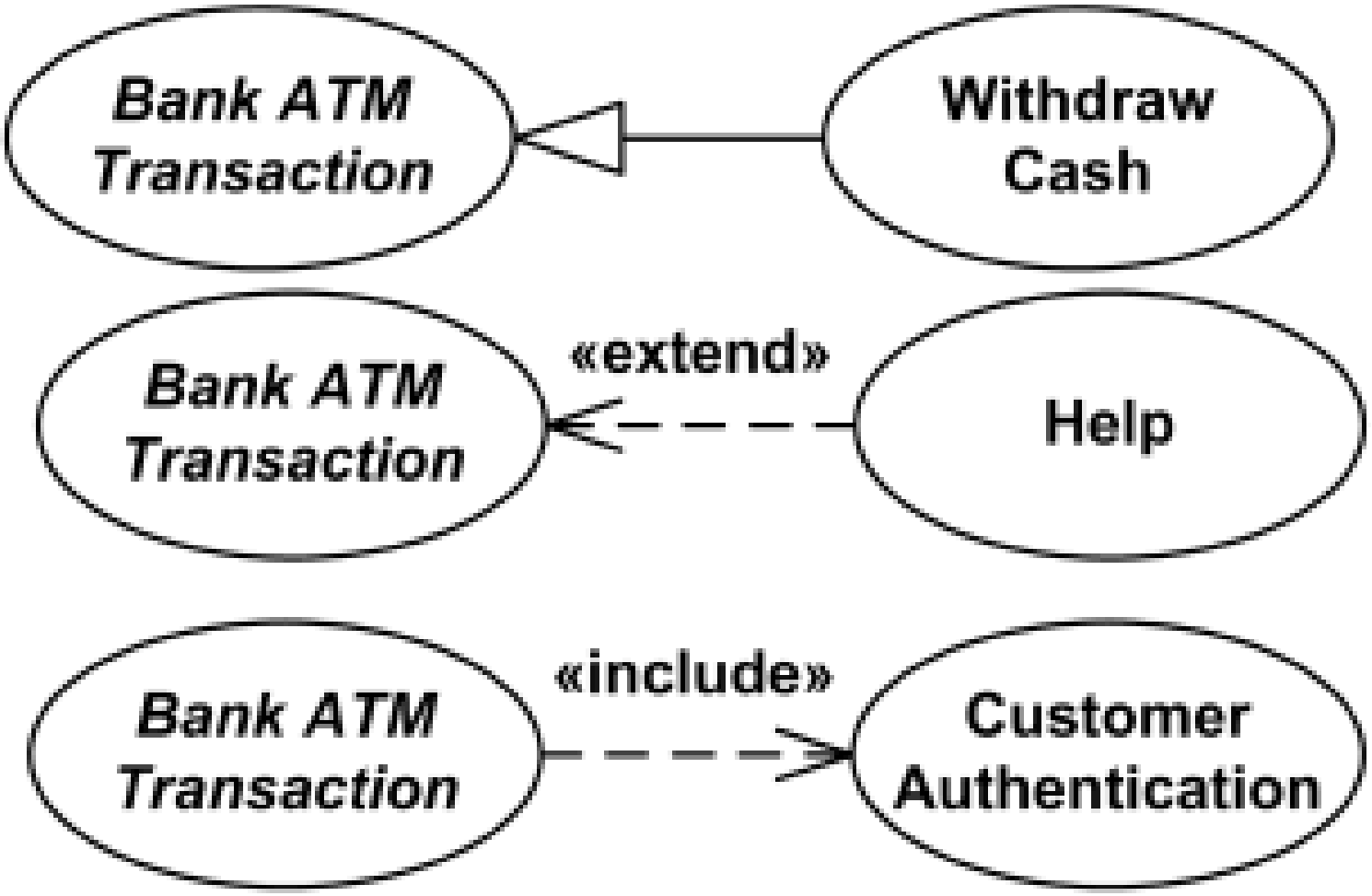
4.2 Elements of a Use Case Diagram

- Relationships
  - ***Generalization***

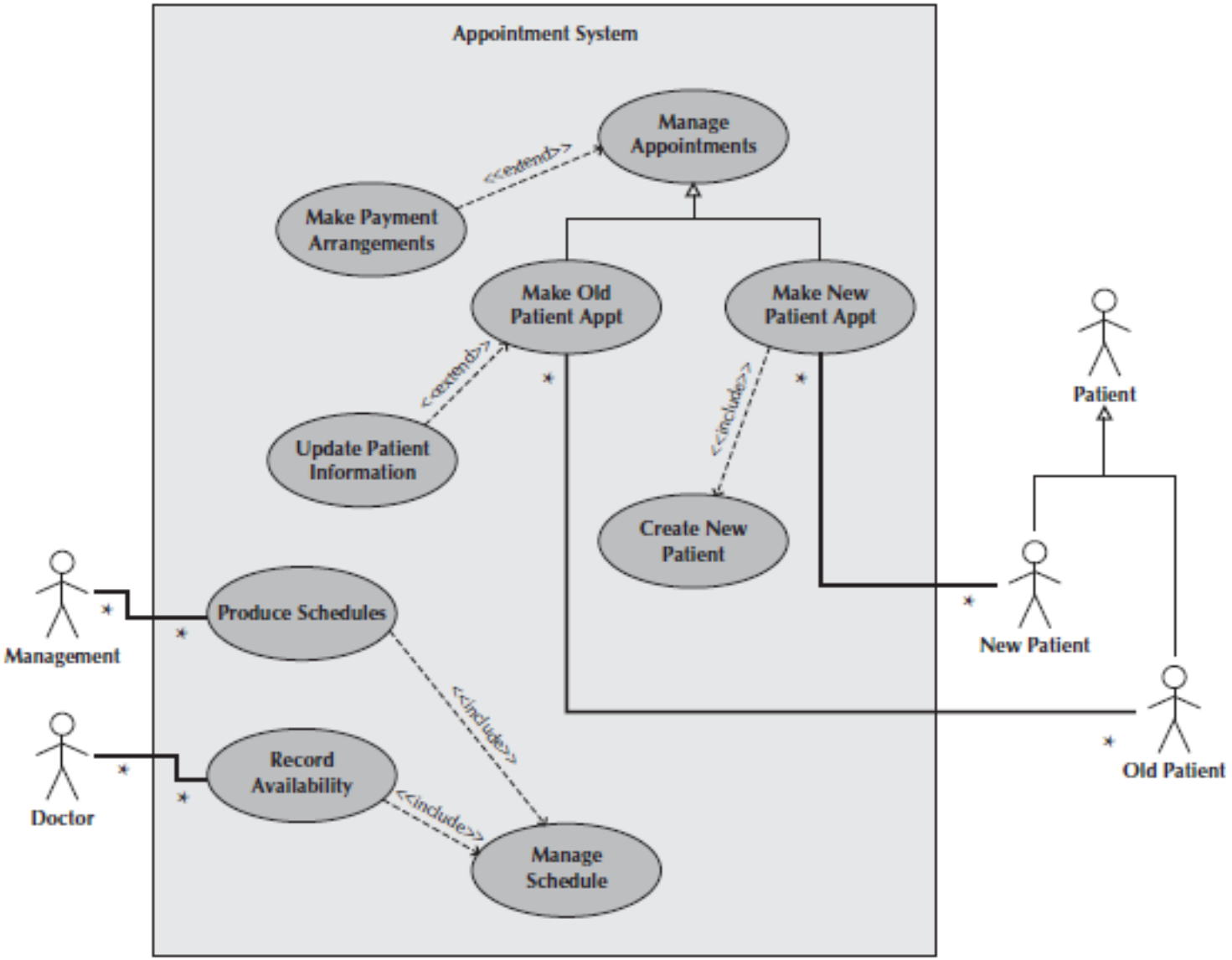


4.2 Elements of a Use Case Diagram

Include, extend and generalization Compared



A Use Case Diagram: An Example



4.3 Creating a Use Case Diagram

- The first step is to **review the requirements definition**. This helps the analyst to get a complete overview of the underlying business process being modeled.
- The second step is to **identify the subject's boundaries**. This helps the analyst to identify the scope of the system. However, as we work through the development process, the boundary of the system most likely will change.
- The third step is to **identify the primary actors and their goals**. The primary actors involved with the system come from a list of stakeholders and users. The goals represent the functionality that the system must provide to the actor

4.3 Creating a Use Case Diagram

- As actors are identified and their goals are uncovered, the boundary of the system will change.
- The fourth step is to simply **identify the business processes** and major use cases.
- The fifth step is to **carefully review the current set of use cases**. It may be necessary to split some of them into multiple use cases or merge some of them into a single use case. Also, based on the current set, a new use case may be identified.

4.3 Creating a Use Case Diagram

- Basically, drawing the use-case diagram is straightforward once use cases have been detailed.
- The only parts drawn on the use-case diagram are the system boundary, the use cases themselves, the actors, and the various associations between these components.

4.4 Business process documentation with use cases and use case descriptions

- Use-case diagrams provide top level view of the basic functionality of the business processes contained in the evolving system.
- Use-case descriptions provide a means to more fully document the different aspects of each individual use case.
- Use-case descriptions contain all the information needed to document the functionality of the business processes.
- Although a use case may contain several paths that a user can take while interacting with the system, each possible execution path through the use case is referred to as a **scenario**.
- Another way to look at a scenario is as if a scenario is an instantiation of a specific use case. Scenarios are used extensively in behavioral modeling

4.4 Business process documentation with use cases and use case descriptions

Scenario – e.g. Purchase Items

- Customer Reviews items in the Shopping Cart
- Customer provides payment and shopping information
- System validate payment Information and respond with confirmation of order
- System will send confirmation of order details to customer in an email.

4.4 Business process documentation with use cases and use case descriptions

- When creating use-case descriptions, the project team must work closely with the users to fully document the functional requirements.
- Organizing the functional requirements and documenting them in a use-case description are a relatively simple process, but it takes considerable practice to ensure that the descriptions are complete enough to use in structural and behavioral modeling.
- A use-case description or **Use Case narrative** contains all the information needed to build the structural and behavioral diagrams that follow, but it expresses the information in a less-formal way that is usually simpler for users to understand.

4.4 Business process documentation with use cases and use case descriptions

Use Case Name: Make Old Patient Appt	ID: 2	Importance Level: Low
Primary Actor: Old Patient	Use Case Type: Detail, Essential	

Stakeholders and Interests:
Old Patient – wants to make, change, or cancel an appointment
Doctor – wants to ensure patient's needs are met in a timely manner

Brief Description: This use case describes how we make an appointment as well as changing or canceling an appointment for a previously seen patient.

Trigger: Patient calls and asks for a new appointment or asks to cancel or change an existing appointment

Type: External

Relationships:
- Association: Old Patient
- Include:
- Extend: Update Patient Information
- Generalization: Manage Appointments

Normal Flow of Events:
1. The Patient contacts the office regarding an appointment.
2. The Patient provides the Receptionist with his or her name and address.
3. If the Patient's information has changed
   Execute the Update Patient Information use case.
4. If the Patient's payment arrangements has changed
   Execute the Make Payments Arrangements use case.
5. The Receptionist asks Patient if he or she would like to make a new appointment, cancel an existing appointment, or change an existing appointment.
   If the patient wants to make a new appointment,
   the S-1: new appointment subflow is performed.
   If the patient wants to cancel an existing appointment,
   the S-2: cancel appointment subflow is performed.
   If the patient wants to change an existing appointment,
   the S-3: change appointment subflow is performed.
6. The Receptionist provides the results of the transaction to the Patient.

SubFlows:
- S-1: New Appointment
  1. The Receptionist asks the Patient for possible appointment times.
  2. The Receptionist matches the Patient's desired appointment times with available dates and times and schedules the new appointment.
- S-2: Cancel Appointment
  1. The Receptionist asks the Patient for the old appointment time.
  2. The Receptionist finds the current appointment in the appointment file and cancels it.
- S-3: Change Appointment
  1. The Receptionist performs the S-2: cancel appointment subflow.
  2. The Receptionist performs the S-1: new appointment subflow.

Alternate/Exceptional Flows:
- S-1, 2a1: The Receptionist proposes some alternative appointment times based on what is available in the appointment schedule.
- S-1, 2a2: The Patient chooses one of the proposed times or decides not to make an appointment.

An Example :
Make Old Patient Appointment

4.4 Business process documentation with use cases and use case descriptions

e.g. High Level Version of a Use-Case Narrative

Author (s): ---------- **Date:----------**
Version: ----------

Use-Case Name:		
Use-Case ID:		**Use-Case Type**
Priority:		**Business Requirements:**
Source:		
Primary Business Actor:		
Other Participating Actors:		
Other Interested Stakeholders:		
Description:		

Importance of the Use Case – typically high , medium , low

There is no standard template for Use Case Narratives.

4.4 Business process documentation with use cases and use case descriptions

e.g. High Level Version of a Use-Case Narrative

Author (s): ---------- **Date:----------**
Version: ----------

Use-Case Name:		**Use-Case Type** **Business Requirements:**
Use-Case ID:		
Priority:		
Source:		
Primary Business Actor:		
Other Participating Actors:		
Other Interested Stakeholders:		
Description:		

Entity that triggers the creation of the Use Case. E.g. Document

4.4 Business process documentation with use cases and use case descriptions

e.g. High Level Version of a Use-Case Narrative

Author (s): ---------- **Date:----------**
Version: ----------

Use-Case Name:		**Use-Case Type** **Business Requirements:** ☐
Use-Case ID:		
Priority:		
Source:		
Primary Business Actor:		
Other Participating Actors:		
Other Interested Stakeholders:		
Description:		

Who benefits from the use case

4.4 Business process documentation with use cases and use case descriptions

e.g. High Level Version of a Use-Case Narrative

Author (s): ---------- **Date:----------**
Version: ----------

Use-Case Name:		**Use-Case Type**
Use-Case ID:		**Business Requirements:**
Priority:		
Source:		
Primary Business Actor:		☐
Other Participating Actors:		
Other Interested Stakeholders:		
Description:		

Facilitating Actors

4.4 Business process documentation with use cases and use case descriptions

e.g. High Level Version of a Use-Case Narrative

Author (s): ---------- **Date:----------**
Version: ----------

Use-Case Name:		
Use-Case ID:		**Use-Case Type**
Priority:		**Business Requirements:**
Source:		
Primary Business Actor:		
Other Participating Actors:		
Other Interested Stakeholders:		
Description:		

General understanding of problem domain and scope

In brief

Sample High-Level Use-Case Narrative

Member Services System

Author (s): (1) _____ **Date:** (2) _____

Version: (3)

Use-Case Name:	Place New Order (4)	**Use-Case Type**
Use-Case ID:	MSS-BUC002.00 (6)	**Business Requirements:** ☑ (5)
Priority:	High (7)	
Source:	Requirement — MSS-R1.00 (8)	
Primary Business Actor:	Club member (9)	
Other Participating Actors:	• Warehouse (external receiver) • Accounts Receivable (external server) (10)	
Other Interested Stakeholders:	• Marketing — Interested in sales activity in order to plan new promotions. (11) • Procurement — Interested in sales activity in order to replenish inventory. • Management — Interested in order activity in order to evaluate company performance and customer (member) satisfaction.	
Description: (12)	This use case describes the event of a club member submitting a new order for SoundStage products. The member's demographic information as well as his or her account standing is validated. Once the products are verified as being in stock, a packing order is sent to the warehouse for it to prepare the shipment. For any product not in stock, a back order is created. On completion, the member will be sent an order confirmation.	

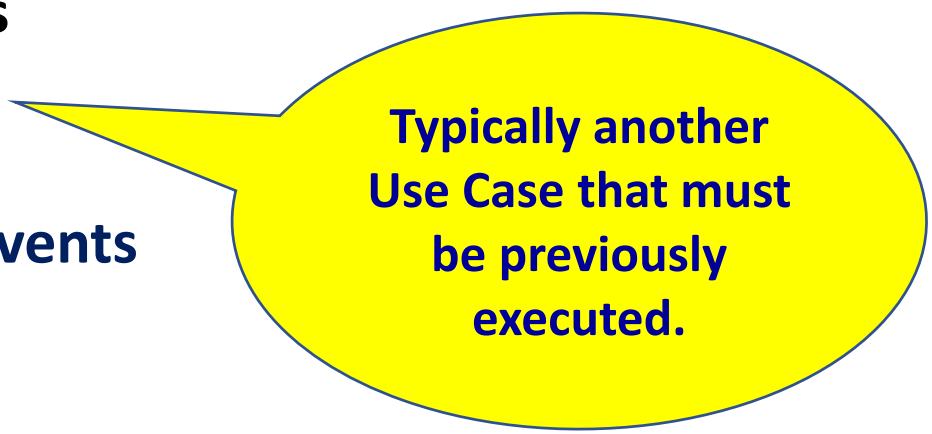
4.4 Business process documentation with use cases and use case descriptions

e.g. Expanded Version of a use-case narrative

More details such as

- **Preconditions**
- **Trigger**
- **Typical Course of Events**
- **Alternate Courses**
- **Post conditions**

etc. are included.



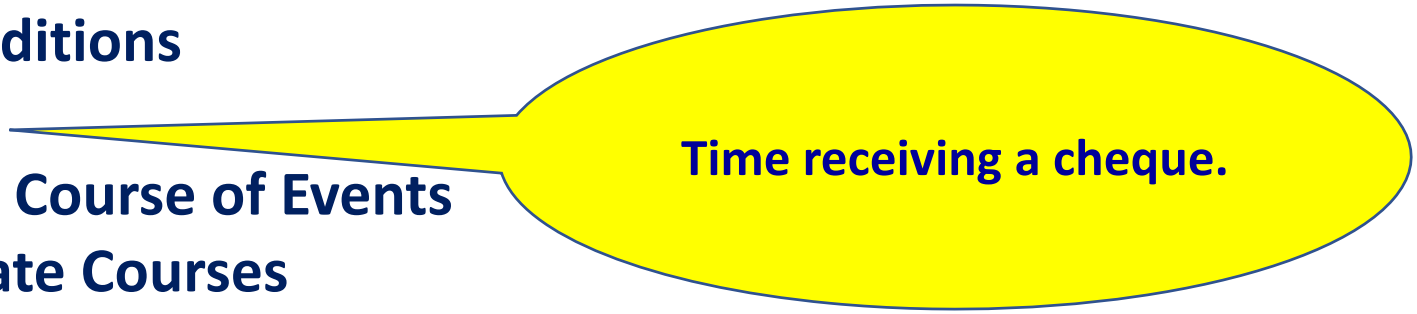
4.4 Business process documentation with use cases and use case descriptions

e.g. Expanded Version of a use-case narrative

More details such as

- **Preconditions**
- **Trigger**
- **Typical Course of Events**
- **Alternate Courses**
- **Post conditions**

etc. are included.



4.4 Business process documentation with use cases and use case descriptions

e.g. Expanded Version of a use-case narrative

More details such as

- **Preconditions**
- **Trigger**
- **Typical Course of Events**
- **Alternate Courses**
- **Post conditions**

etc. are included.

eg. Borrowing :
checkMember,
checkOverdue,
checkOverLimit,
checkCopyBorrowable,
confirm Borrowing

4.4 Business process documentation with use cases and use case descriptions

e.g. Expanded Version of a use-case narrative

More details such as

- **Preconditions**
- **Trigger**
- **Typical Course of Events**
- **Alternate Courses**
- **Post conditions**

etc. are included.

4.4 Business process documentation with use cases and use case descriptions

e.g. Expanded Version of a use-case narrative

More details such as

- **Preconditions**
- **Trigger**
- **Typical Course of Events**
- **Alternate Courses**
- **Post conditions**

etc. are included.

Summary

- Use Case Modeling is the process of modeling a system's functions in terms of business events, who initiated the events, and how the system responds to those events.
- Shows the interactions between the system and external systems / users.
- Graphically describes who will use the system and in what ways the user expects to interact with the system.
- A Subject Boundary represents the scope of the subject.
- The elements of a use-case diagram include actors, use cases, subject boundaries, and a set of relationships among actors, actors and use cases, and use cases. These relationships consist of association, include, extend, dependency and generalization relationships.
- Actor is anyone or anything that needs to interact with the system to exchange information.

Summary cont...

- Actors can be associated with other actors using a specialization/superclass association and are labelled with a noun phrase.
- A use case represents a major piece of system functionality.
- A Use Case can extend another use case or can include another use case.
- A Use Case is placed inside the system boundary and is labeled with a descriptive verb–noun phrase.
- An association relationship links an actor with the use case(s) with which it interacts.
- An include relationship represents the inclusion of the functionality of one use case within another and has an arrow drawn from the base use case to the used use case.

Summary cont...

- An extend relationship represents the extension of the use case to include optional behavior and has an arrow drawn from the extension use case to the base use case.
- Generalization relationship represents a specialized use case to a more generalized one and has an arrow drawn from the specialized use case to the base use case.
- Steps to create a Use Case Diagram are:
  - review the requirements definition, identify the subject's boundaries, identify the primary actors and their goals, simply identify the business processes and major use cases, and carefully review the current set of use cases.
  - It may be necessary to split some of them into multiple use cases or merge some of them into a single use case. Also, based on the current set, a new use case may be identified.

Summary cont...

- Use-case descriptions/narratives provide a means to more fully document the different aspects of each individual use case.
- Use-case descriptions contain all the information needed to document the functionality of the business processes.
- A use-case description or Use Case narrative contains all the information needed to build the structural and behavioral diagrams that follow, but it expresses the information in a less-formal way that is usually simpler for users to understand.
- Most analysts first start with a high-level version of a narrative and subsequently prepare the expanded version. There is no standard template exist for use case narratives.