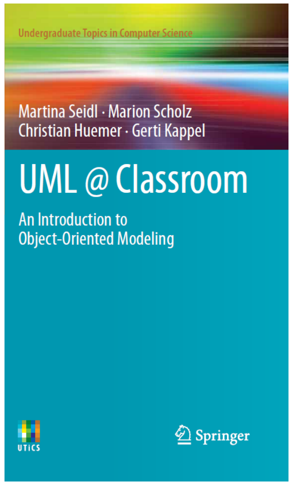
Business Informatics Group

Vienna University of Technology

Object-Oriented Modeling

Use Case Diagram – Advanced Mode

Slides accompanying UML@Classroom
Version 1.0


Undergraduate Topics in Computer Science

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UML @ Classroom

An Introduction to
Object-Oriented Modeling

UTICS

Springer

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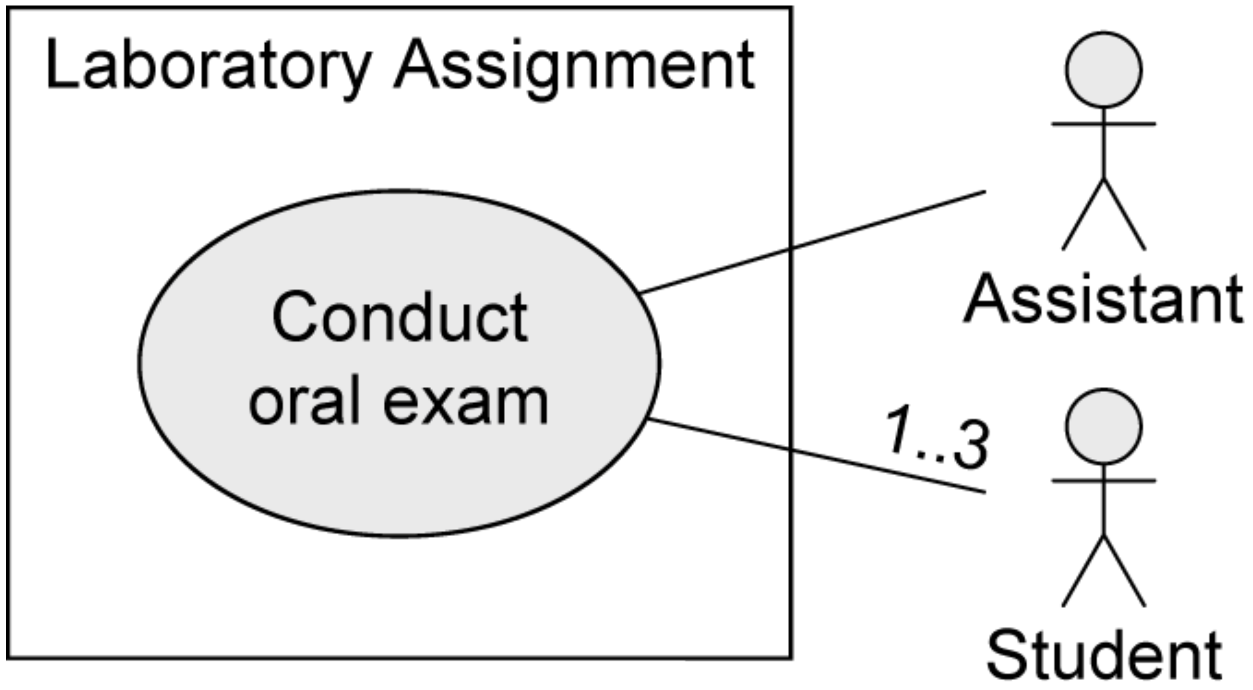
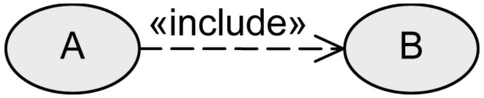
Relationships between Use Cases and Actors

- Actors are connected with use cases via solid lines (*associations*).
- Every actor must communicate with at least one use case.
- An association is always binary.
- Multiplicities may be specified.

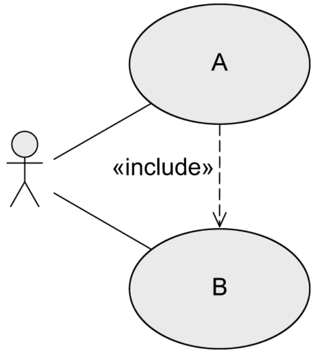


Relationships between Use Cases

«inlcude» - Relationship



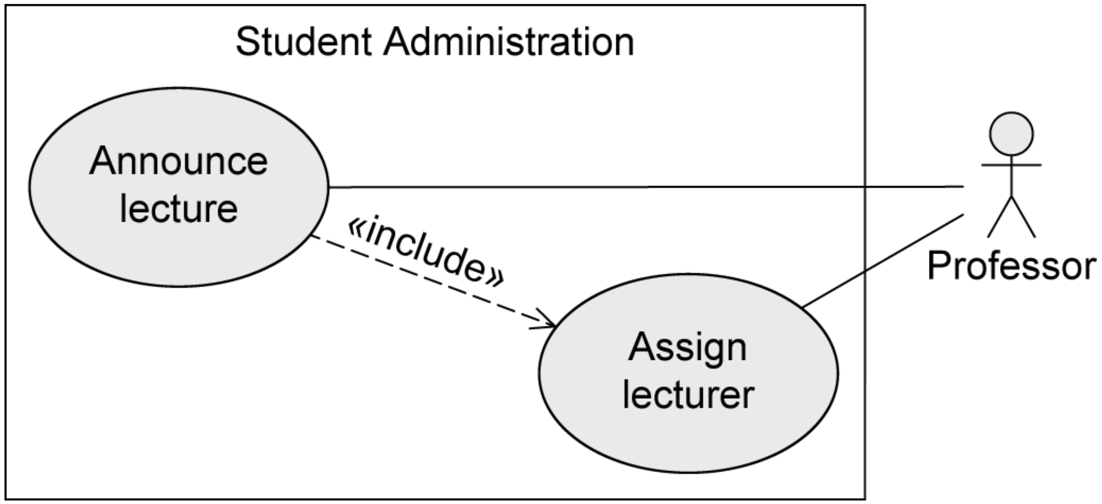
- The behavior of one use case (included use case) is integrated in the behavior of another use case (base use case)



Base use case
requires the behavior of the included use case to be able to offer its functionality

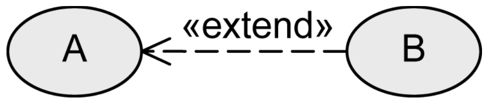
Included use case
may be executed on its own

- Example:

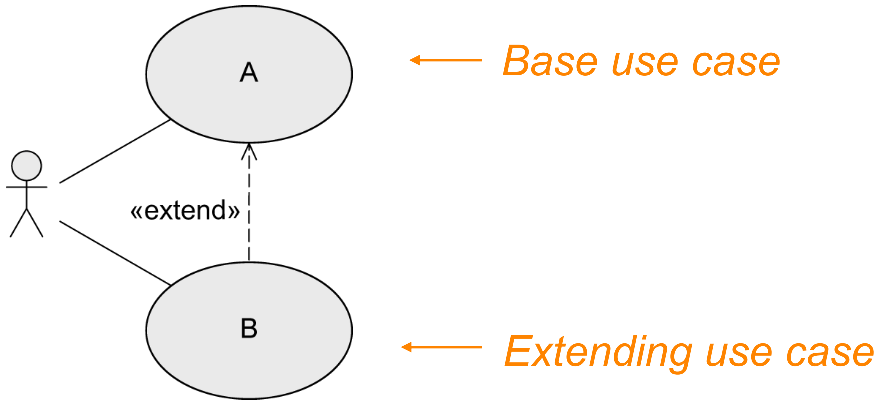


Relationships between Use Cases

«extend» - Relationship



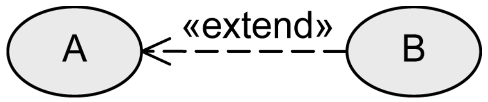
- The behavior of one use case (extending use case) may be integrated in the behavior of another use case (base use case) but does not have to.
- Both use cases may also be executed independently of each other.



- A decides if B is executed.
- Extension points define at which point the behavior is integrated.
- Conditions define under which circumstances the behavior is integrated.

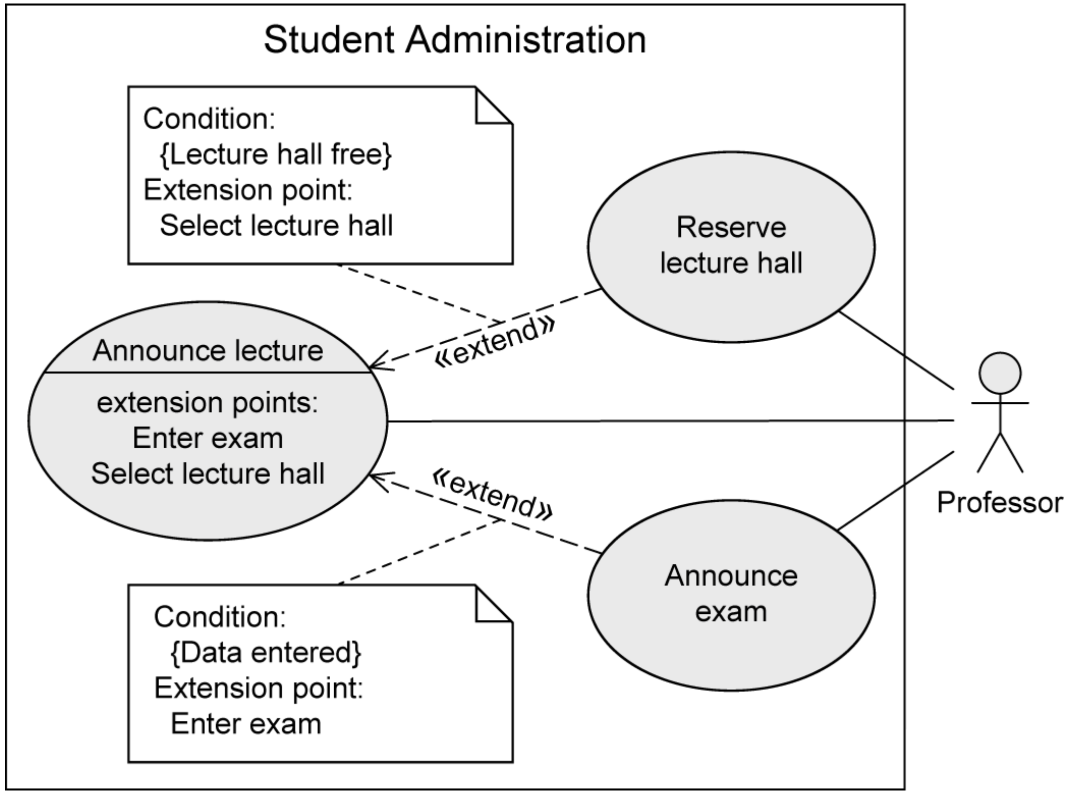
Relationships between Use Cases

«extend» - Relationship: Extension Points



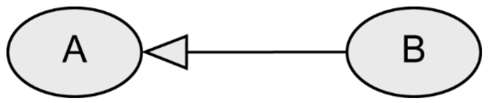
- Extension points are written directly within the use case.
- Specification of multiple extension points is possible.

- Example:

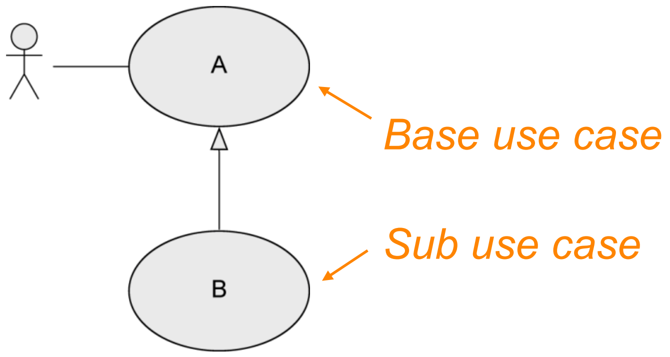


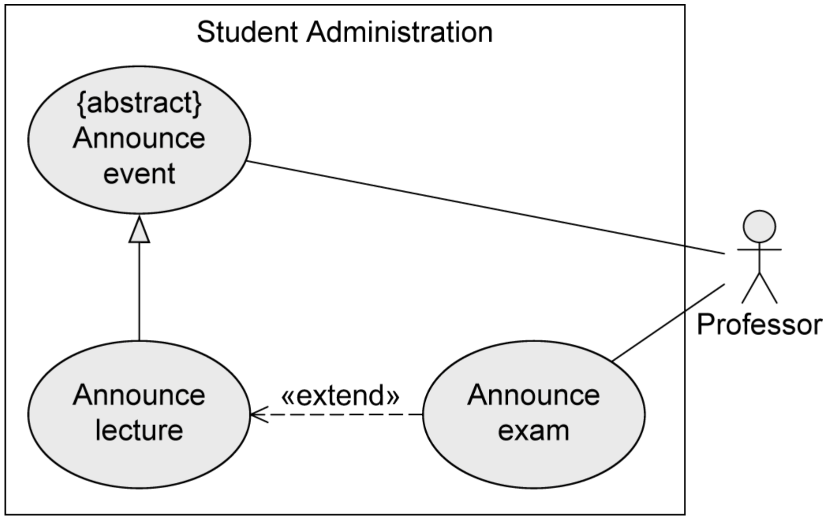
Relationships between Use Cases

Generalization of Use Cases



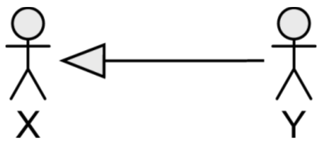
- Use case **A** generalizes use case **B**.
- **B** inherits the behavior of **A** and may either extend or overwrite it.
- **B** also inherits all relationships from **A**.
- **B** adopts the basic functionality of **A** but decides itself what part of A is executed or changed.
- **A** may be labeled **{abstract}**
  - Cannot be executed directly
  - Only **B** is executable
- Example:



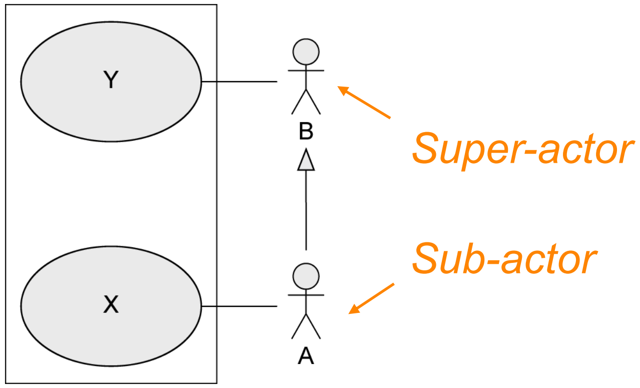


Relationships between Actors

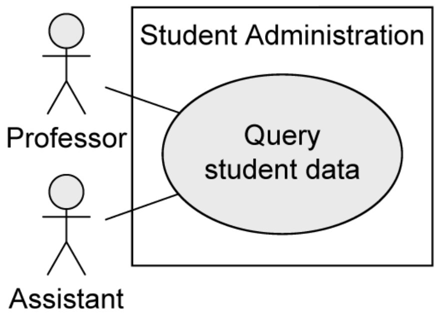
Generalization of Actors



- Actor **A** inherits from actor **B**.
- **A** can communicate with **X** and **Y**.
- **B** can only communicate with **Y**.
- *Multiple inheritance* is permitted.
- *Abstract* actors are possible.



- Example:



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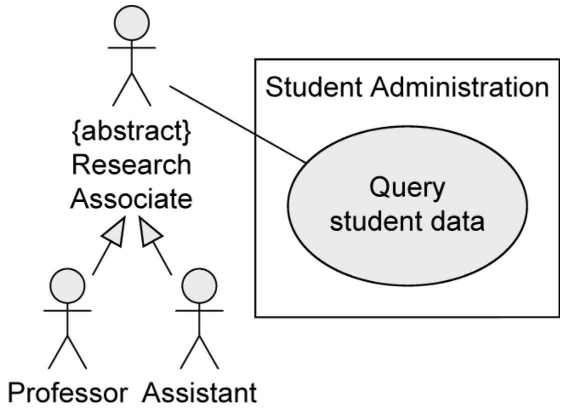


Professor AND **Assistant** needed for executing **Query student data**

Professor OR **Assistant** needed for executing **Query student data**

Description of Use Cases

- Structured approach
  - Name
  - Short description
  - Precondition: prerequisite for successful execution
  - Postcondition: system state after successful execution
  - Error situations: errors relevant to the problem domain
  - System state on the occurrence of an error
  - Actors that communicate with the use case
  - Trigger: events which initiate/start the use case
  - Standard process: individual steps to be taken
  - Alternative processes: deviations from the standard process

[A. Cockburn: Writing Effective Use Cases, Addison Wesley, 2000]

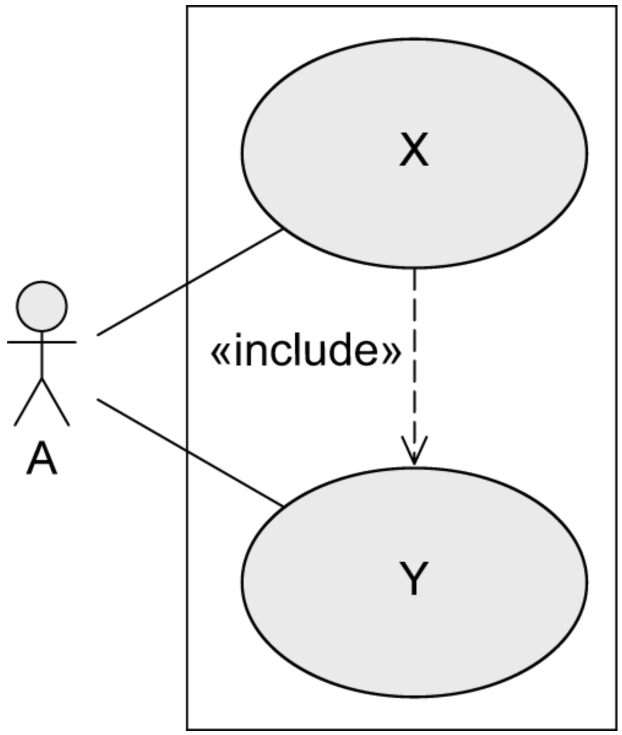
Description of Use Cases - Example

- Name: `Reserve lecture hall`
- Short description: An employee reserves a lecture hall at the university for an event.
- Precondition: The employee is authorized to reserve lecture halls.
- Postcondition: A lecture hall is reserved.
- Error situations: There is no free lecture hall.
- System state in the event of an error: The employee has not reserved a lecture hall.
- Actors: `Employee`
- Trigger: Employee requires a lecture hall.
- Standard process: (1) Employee logs in to the system.
  (2) Employee selects the lecture hall.
  (3) Employee selects the date.
  (4) System confirms that the lecture hall is free.
  (5) Employee confirms the reservation.
- Alternative processes: (4') Lecture hall is not free.
  (5') System proposes an alternative lecture hall.
  (6') Employee selects alternative lecture hall and confirms the reservation.

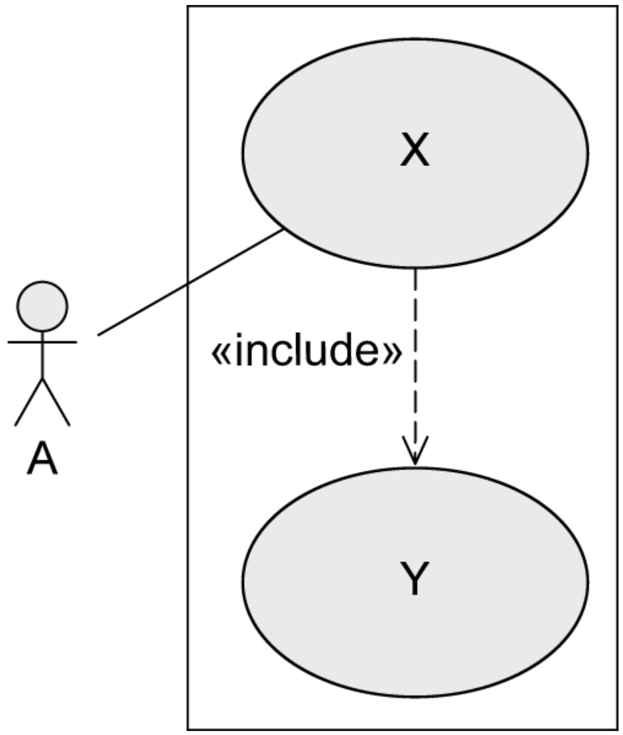
Best Practices

«include»

UML standard



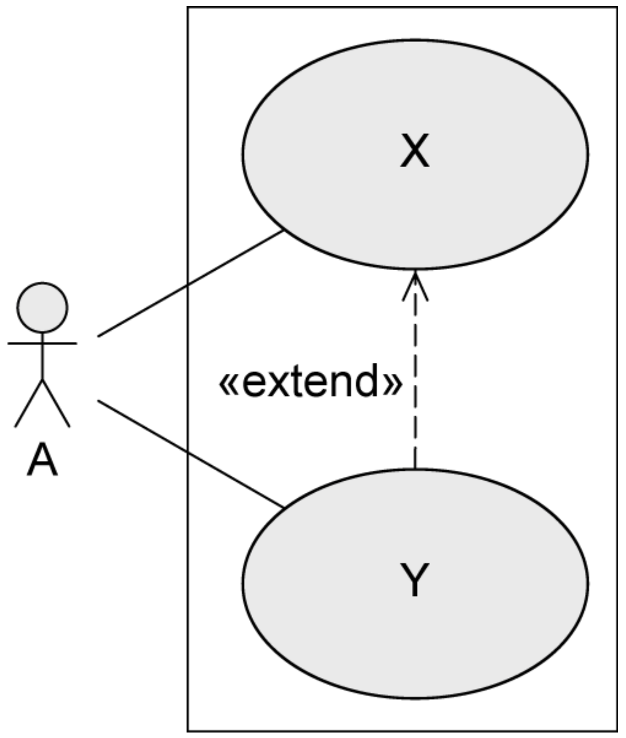
Best practice



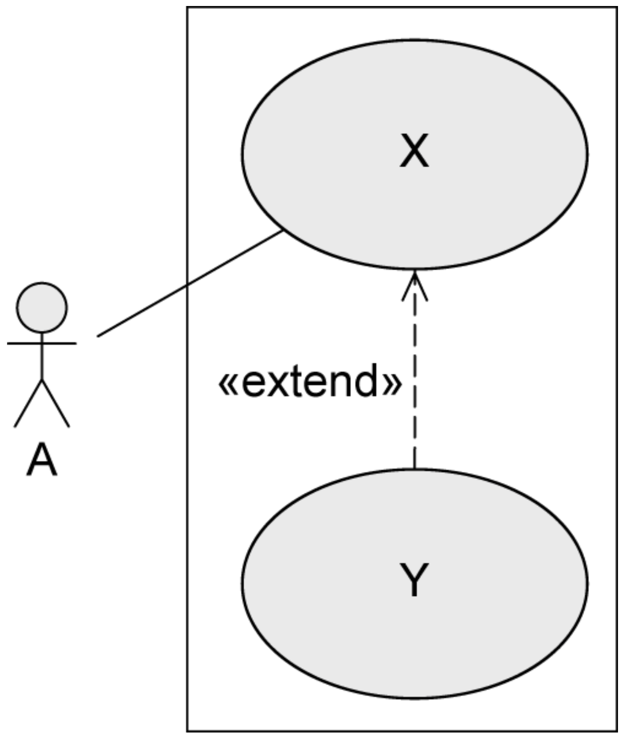
Best Practices

«extend»

UML standard



Best practice



Best Practices

Identifying Actors

- Who uses the main use cases?
- Who needs support for their daily work?
- Who is responsible for system administration?
- What are the external devices/(software) systems with which the system must communicate?
- Who is interested in the results of the system?

Best Practices

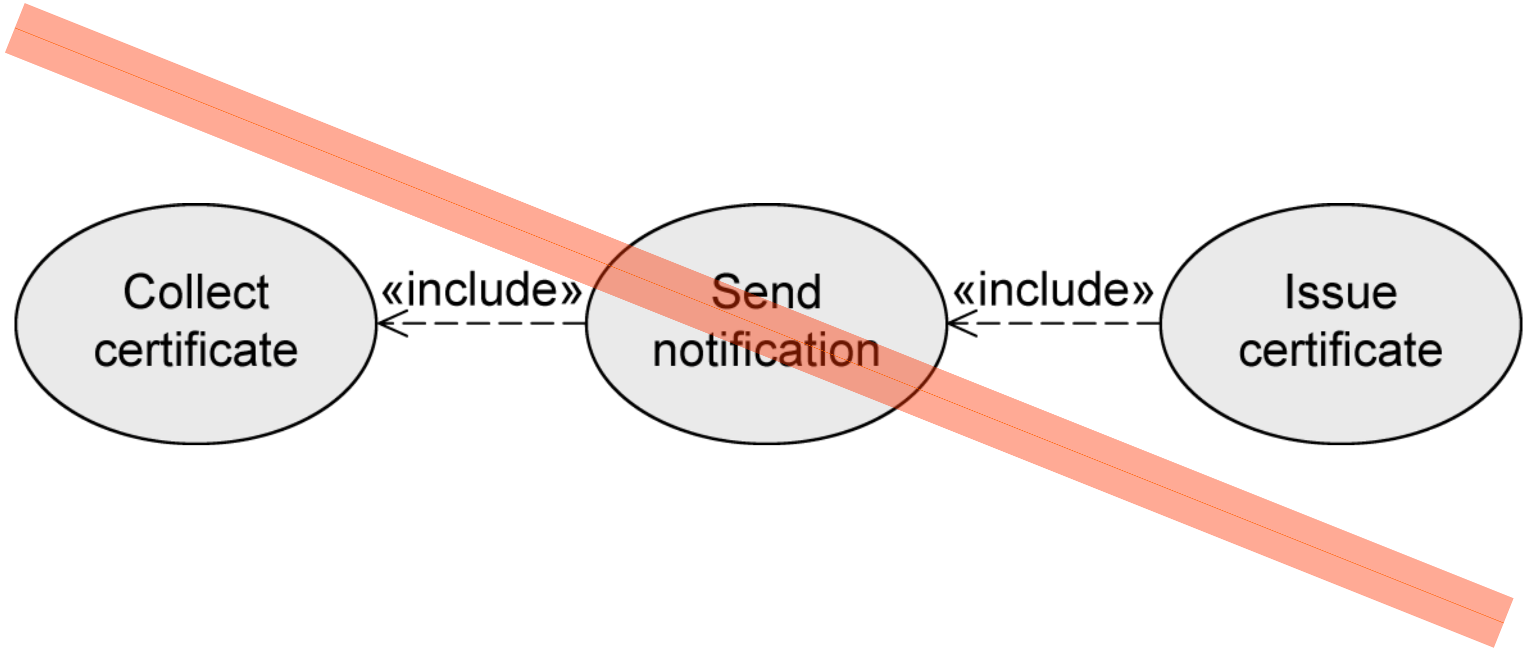
Identifying Use Cases

- What are the main tasks that an actor must perform?
- Does an actor want to query or even modify information contained in the system?
- Does an actor want to inform the system about changes in other systems?
- Should an actor be informed about unexpected events within the system?

Best Practices

Typical Errors To Avoid (1/5)

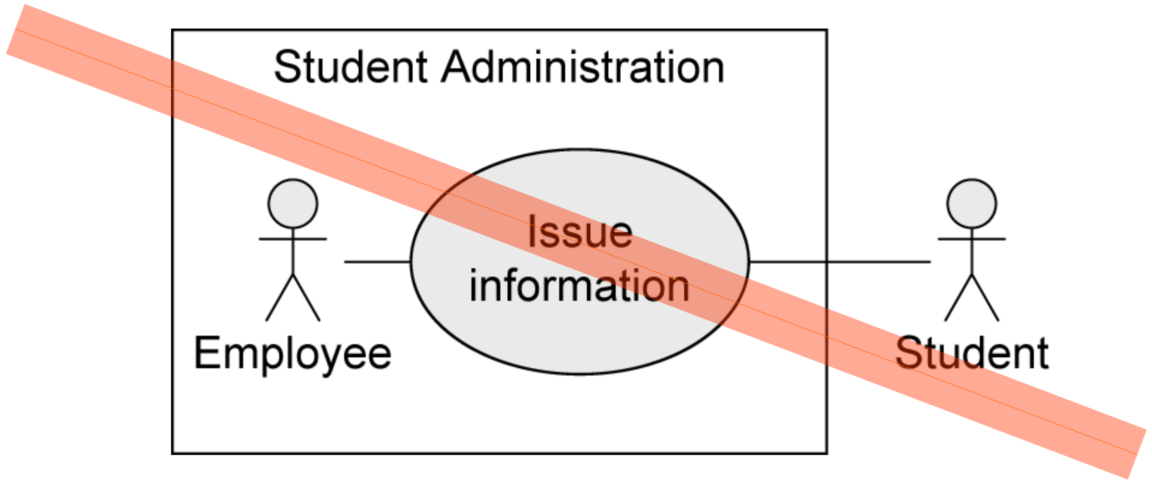
- Use case diagrams do not model processes/workflows!



Best Practices

Typical Errors To Avoid (2/5)

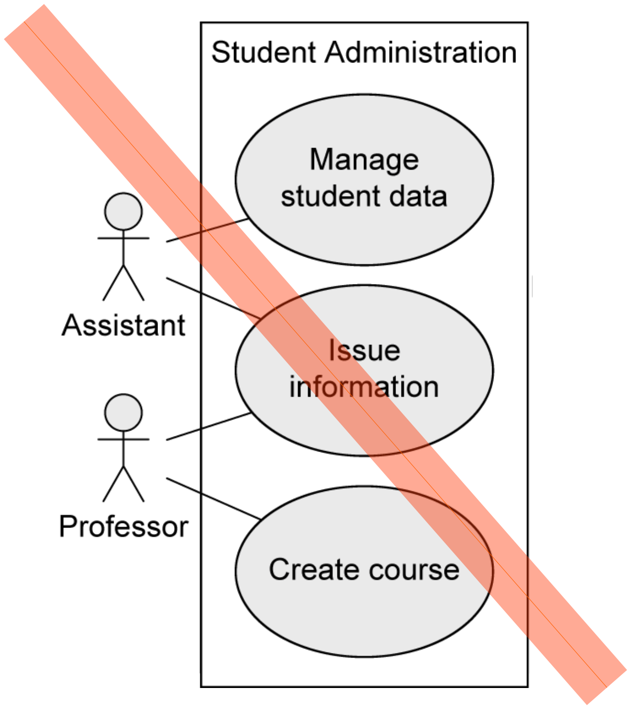
- Actors are not part of the system, hence, they are positioned outside the system boundaries!

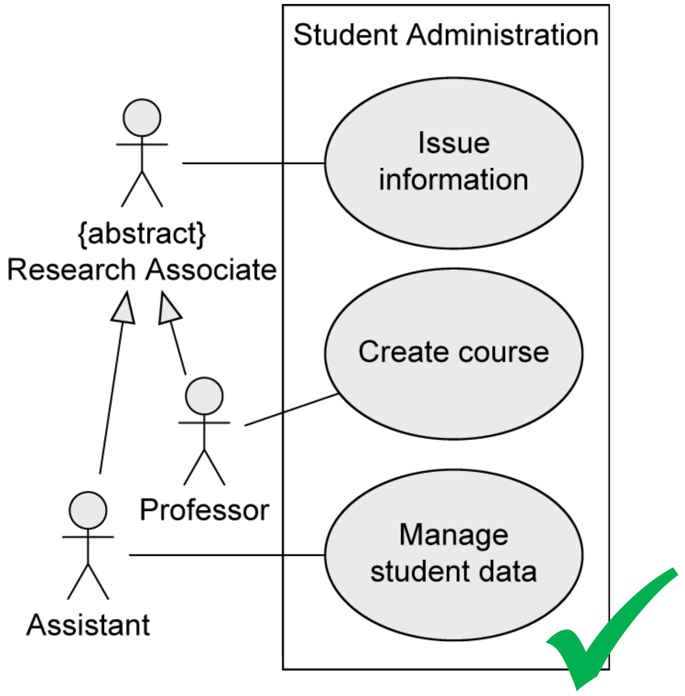


Best Practices

Typical Errors To Avoid (3/5)

- Use case **`Issue information`** needs **EITHER** one actor **`Assistant`** **OR** one actor **`Professor`** for execution

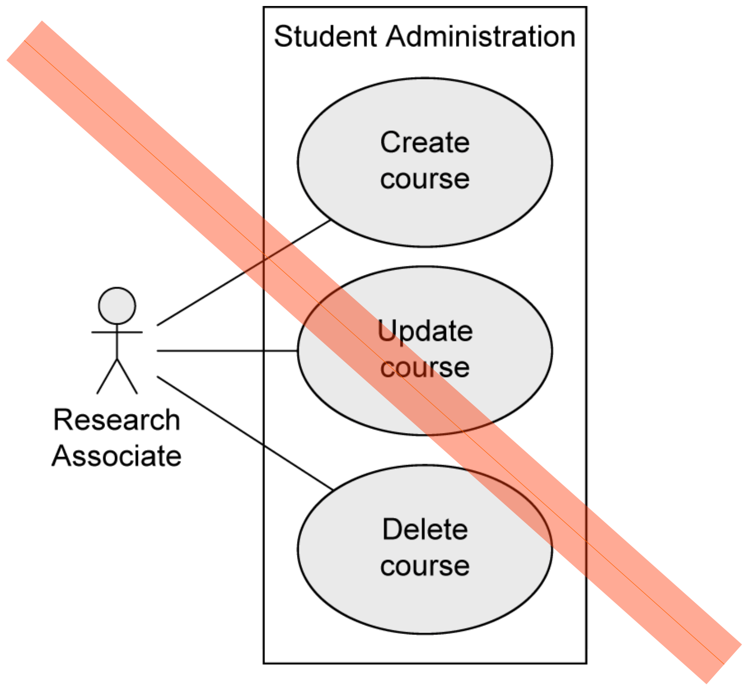


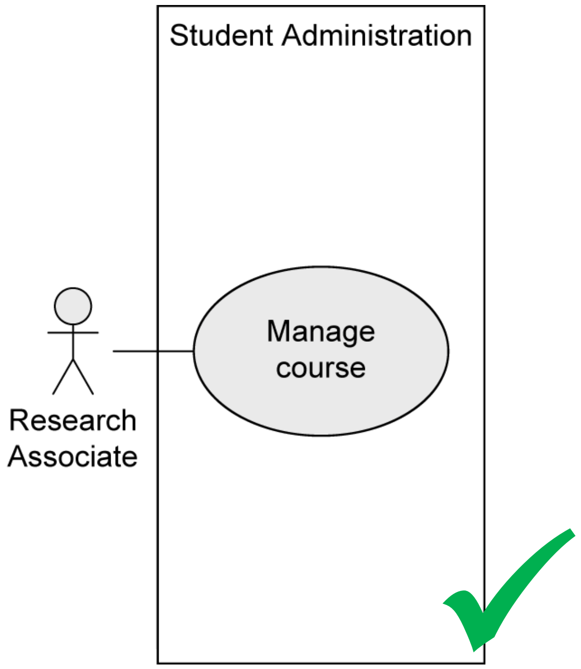


Best Practices

Typical Errors To Avoid (4/5)

- Many small use cases that have the same objective may be grouped to form one use case

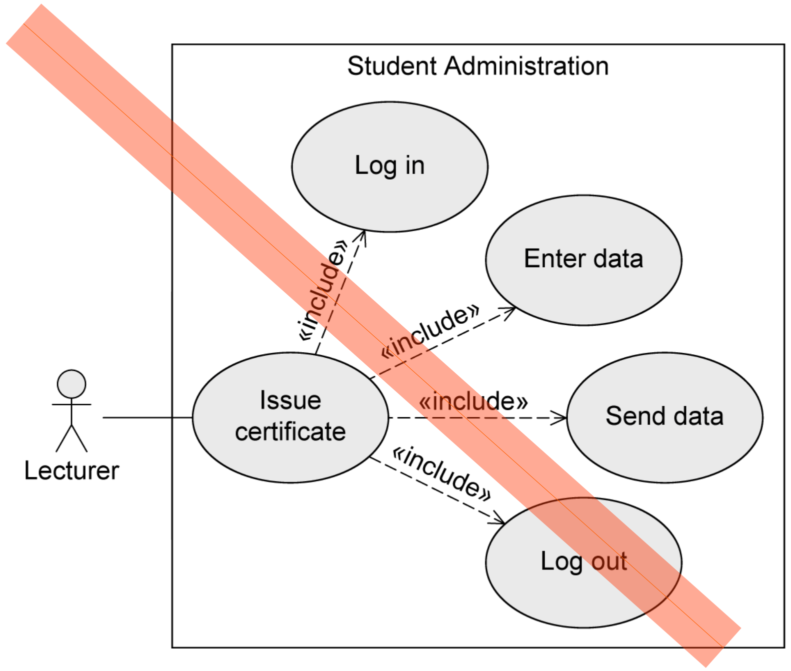


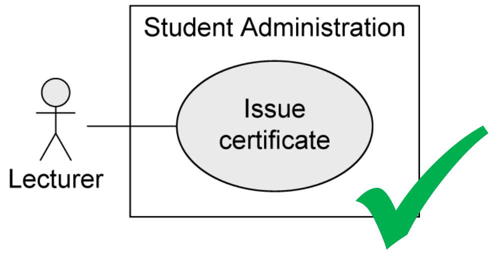


Best Practices

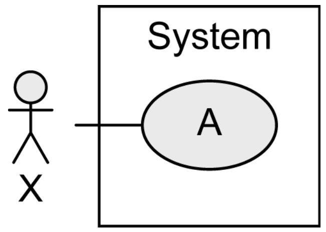
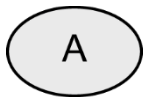
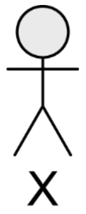
Typical Errors To Avoid (5/5)

- The various steps are part of the use cases, not separate use cases themselves! -> NO functional decomposition

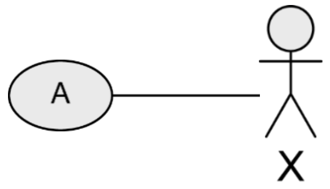
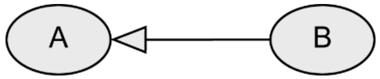
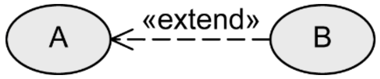
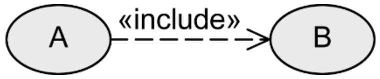




Notation Elements (1/2)

Name	Notation	Description
System		Boundaries between the system and the users of the system
Use case		Unit of functionality of the system
Actor		Role of the users of the system

Notation Elements (2/2)

Name	Notation	Description
Association		Relationship between use cases and actors
Generalization		Inheritance relationship between actors or use cases
Extend relationship		B extends A: optional use of use case B by use case A
Include relationship		A includes B: required use of use case B by use case A