

Web Application Development

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Interaction Modeling- Use Case Models

- Actors - An actor is direct external user of the system
- An object or set of objects that communicates directly with the system but that is not part of the system.
- Each actor represent those objects that behave in particular way toward the system
- For example, our project management system involves various types of users, including project managers, resource managers, human resources, and system administrators. These users are all actors.

Interaction Modeling- Use Case Models

- An actor is external to a system, interacts with the system, may be a human user or another system, and has goals and responsibilities to satisfy in interacting with the system.
- Actors address the question of who and what interacts with a system.
- An actor is shown as a "stick figure" icon

Interaction Modeling- Use Case Models

- Various actors associated with the project management system
- A project manager - Responsible for ensuring that a project delivers a quality product within specified time and cost, and within specified resource constraints
- A resource manager - Responsible for ensuring that trained and skilled human resources are available for projects
- A human resource - Responsible for ensuring that worker skills are maintained, and that quality work is completed for a project.
- A system administrator - Responsible for ensuring that a project management system is available for a project

Interaction Modeling- Use Case Models

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- customer and
- repair technician.

Interaction Modeling- Use Case Models

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Interaction Modeling- Use Case Models

- For a travel agency system, actors might include
 - A travel agency is a private retailer or public service that provides travel and tourism-related services to the general public
 - traveler
 - agent and
 - airline

Interaction Modeling- Use Case Models

- For a computer database system, actors might include

Interaction Modeling- Use Case Models

- For a computer database system, actors might include
- user and

Interaction Modeling- Use Case Models

- For a computer database system, actors might include
 - user and
 - administrator
- Actors can be persons, devices, and other systems — anything that interacts directly with the system

Interaction Modeling- Use Case Models

- An object can be bound to multiple actors if it has different facets to its behavior
- For example, the objects Mary, Frank, and Paul may be customers of a vending machine.
- Paul may also be a repair technician for the vending machine.
- An actor has a single well-defined purpose.

Interaction Modeling- Use Case Models

- In contrast, objects and classes often combine many different purposes.
- An actor represents a particular facet of objects in its interaction with a system.
- The same actor can represent objects of different classes that interact similarly toward a system
- For example, even though many different individual persons use a vending machine, their behavior toward the vending-machine can all be summarized by the actors customer and repair technician.
- Each actor represents a coherent set of capabilities for its objects.

Interaction Modeling- Use Case Models

- Modeling the actors helps to define a system by identifying the objects within the system and those on its boundary.
- An actor is directly connected to the system an indirectly connected object is not an actor and should not be included as part of the system model.
- Any interactions with an indirectly connected object must pass through the actors
- For example, the dispatcher of repair technicians from a service bureau is not an actor of a vending machine—only the repair technician interacts directly with the machine.

Interaction Modeling- Use Case Models

- If it is necessary to model the interactions among such indirect objects, then a model should be constructed of the environment itself as a larger system.
- For example, it might be useful to build a model of a repair service that includes dispatchers, repair technicians, and vending machines as actors, but that is a different model from the vending machine model.

Interaction Modeling- Use Case Models

- The various interactions of actors with a system are quantized into use cases.
- A use case is a coherent piece of functionality that a system can provide by interacting with actors
- For example, a customer actor can buy a beverage from a vending machine.
- The customer inserts money into the machine, makes a selection, and ultimately receives a beverage
- Similarly, a repair technician can perform scheduled maintenance on a vending machine.

Interaction Modeling- Use Case Models

- Each use case involves one or more action as well as the system itself.
- The use case buy a beverage involves the customer actor and the use case perform scheduled maintenance involves the repair technician actor.
- In a telephone system, the use case make a call involves two actors, a caller and a receiver.

Interaction Modeling- Use Case Models

- The actors need not all be persons.
- The use-case make a trade on an online stock broker involves a customer actor and a stock exchange actor.
- The stock broker system needs to communicate with both actors to execute a trade.

Interaction Modeling- Use Case Models

- A usecase involves a sequence of messages among the system and its actor.
- For example in the buy a beverage use case, the customer first inserts a coin and the vending machine displays the the amount deposited.
- This can be repeated several times.
- Then the customer pushes a button to indicate a selection; the vending machine dispenses the beverage and issue change, if necessary.

Interaction Modeling- Use Case Models

- **Buy a beverage.** The vending machine delivers a beverage after a customer selects and pays for it.
- **Perform scheduled maintenance.** A repair technician performs the periodic service on the vending machine necessary to keep it in good working condition.
- **Make repairs.** A repair technician performs the unexpected service on the vending machine necessary to repair a problem in its operation.
- **Load items.** A stock clerk adds items into the vending machine to replenish its stock of beverages.

Figure 1. Usecase Summaries for a Vending Machine

Interaction Modeling- Use Case Models

- Some use cases have a fixed sequence of messages.
- More often, however, the message sequence may have some variations.
- For example, a customer-can deposit a variable number of coins in the buy a beverage use case. Depending on the money inserted and the item selected, the machine may, or may not, return change.
- You can represent such variability by showing several examples of distinct behavior sequences.

Interaction Modeling- Use Case Models

- Typically you should first define a mainline behavior sequence, then define optional subsequences, repetitions, and other variations.
- Error conditions are also part of a use case.
- For example, if the customer selects a beverage whose supply is exhausted, the vending machine displays a warning message.
- Similarly, the vending transaction can be cancelled.

Interaction Modeling- Use Case Models

- A use case brings together all of the behavior relevant to a slice of system functionality. This includes normal mainline behavior, variations on normal behavior, exception conditions, error conditions, and cancellations of a request.
- Figure explains the buy a beverage use case in detail.
- Grouping normal and abnormal behavior under a single use case helps to ensure that all the consequences of an interaction are considered together.

Interaction Modeling- Use Case Models

Use Case: Buy a beverage

Summary: The vending machine delivers a beverage after a customer selects and pays for it.

Actors: Customer

Preconditions: The machine is waiting for money to be inserted.

Description: The machine starts in the waiting state in which it displays the message "Enter coins." A customer inserts coins into the machine. The machine displays the total value of money entered and lights up the buttons for the items that can be purchased for the money inserted. The customer pushes a button. The machine dispenses the corresponding item and makes change, if the cost of the item is less than the money inserted.

Exceptions:

Canceled: If the customer presses the cancel button before an item has been selected, the customer's money is returned and the machine resets to the waiting state.

Out of stock: If the customer presses a button for an out-of-stock item, the message "That item is out of stock" is displayed. The machine continues to accept coins or a selection.

Insufficient money: If the customer presses a button for an item that costs more than the money inserted, the message "You must insert \$nn.nn more for that item" is displayed, where nn.nn is the amount of additional money needed. The machine continues to accept coins or a selection.

No change: If the customer has inserted enough money to buy the item but the machine cannot make the correct change, the message "Cannot make correct change" is displayed and the machine continues to accept coins or a selection.

Postconditions: The machine is waiting for money to be inserted.

Figure 2. Use case Description: A use case brings together all of the behavior relevant to a slice of system functionality

Use Case Diagrams

- A system involves a set of use cases and a set of actors.
- Each use case represents a slice of the functionality the system provides.
- The set of use cases shows the complete functionality of the system at some level of detail.
- Similarly, each actor represents one kind of object for which the system can perform behavior.
- The set of actors represents the complete set of objects that the system can serve.

Use Case Diagrams

- The Unified Modeling Language (UML) has a graphical notation for summarizing use cases and figure shows an example.
- A rectangle contains the use cases for a system with the actors listed on the outside.
- The name of the system may be written near a side of the rectangle.
- A name within an ellipse denotes a use case.
- A "stick man" icon denotes an actor, with the name being placed below or adjacent to the icon.

Use Case Diagrams

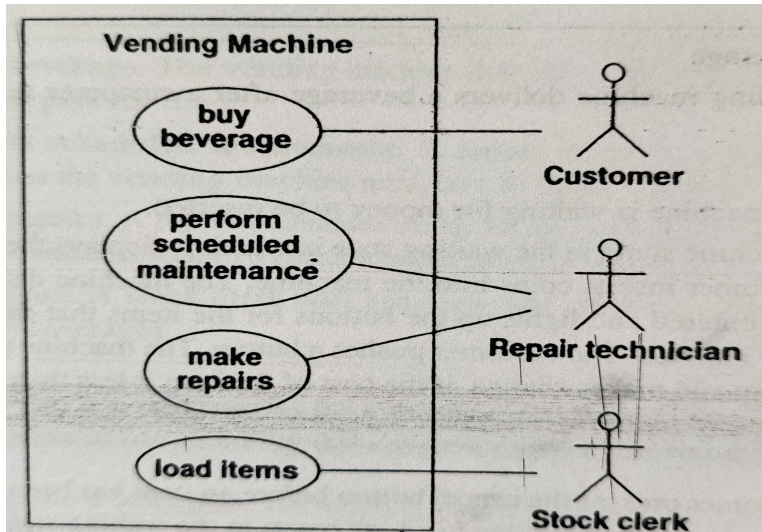


Figure 3. Use case Diagram for vending machine. A system involves a set of use cases and set of actors

Use Case Diagrams

- Solid lines connect use cases to participating actors.
- In the figure, the actor, Repair technician participates in two use cases, the others in one each.
- Multiple actors can participate in a use case even though the example has only one actor per use case.

Guidelines for Use Case Models

- Use cases identify the functionality of a system and organize it according to the perspective of users.
- Here are some guidelines for constructing use case models. variations.
- **First determine the system boundary.** It is impossible to identify use cases or actors if the system boundary is unclear.
- **Ensure that actors are focused.** Each actor should have a single, coherent purpose.

Guidelines for Use Case Models

- If a real-world object embodies multiple purposes, capture them with separate actors.
- For example, the owner of a personal computer may install software, set up a database, and send email variations.
- These functions differ greatly in their impact on the computer system and the potential for system damage.
- They might be broken into three actors: system administrator, database administrator, and computer user

Guidelines for Use Case Models

- Each use case must provide value to users. A use case should represent a complete transaction that provides value to users and should not be defined too narrowly.
- For example, dial a telephone number is not a good use case for a telephone system.
- It does not represent a complete transaction of value by itself; it is merely part of the use case make telephone call.
- The latter use case involves placing the call, talking, and terminating the call.

Guidelines for Use Case Models

- **Relate use cases and actors.**
- Every use case should have at least one actor, and every actor should participate in at least, one use case.
- A use case may involve several actors, and an actor may participate in several use cases.

Guidelines for Use Case Models

- **Remember that use cases are informal.**
- It is important not to be obsessed by formalism in specifying use cases.
- They are not intended as a formal mechanism but as a way to identify and organize system functionality from a user-centered point of view.
- It is acceptable if use cases are a bit loose at first