Lecture 17: Modelling System Interactions

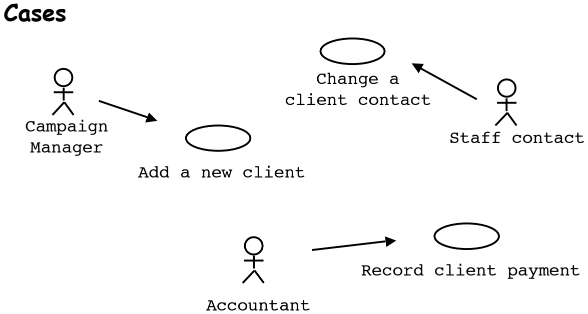
- **Interactions with the new system**
  - How will people interact with the system?
  - When/Why will they interact with the system?
- **Use Cases**
  - introduction to use cases
  - identifying actors
  - identifying cases
  - Advanced features
- **Sequence Diagrams**
  - Temporal ordering of events involved in a use case

Moving towards specification

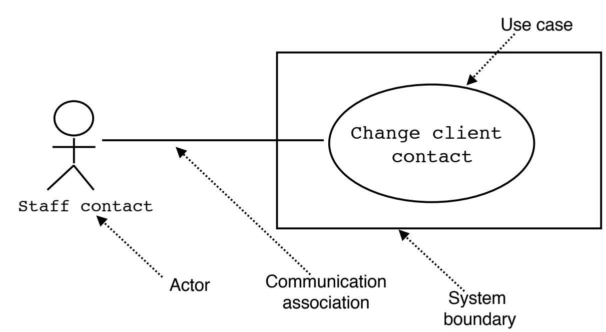
- **What functions will the new system provide?**
  - How will people interact with it?
  - Describe functions from a user's perspective
- **UML Use Cases**
  - Used to show:
    - the functions to be provided by the system
    - which actors will use which functions
  - Each Use Case is:
    - a pattern of behavior that the new system is required to exhibit
    - a sequence of related actions performed by an actor and the system via a dialogue.
- **An actor is:**
  - anything that needs to interact with the system:
    - a person
    - a role that different people may play
    - another (external) system.

Use Case Diagrams

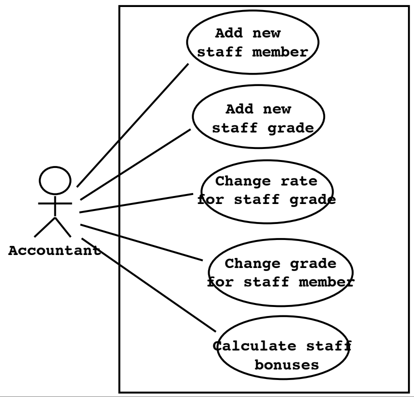
- **Capture the relationships between actors and Use Cases**



Notation for Use Cases

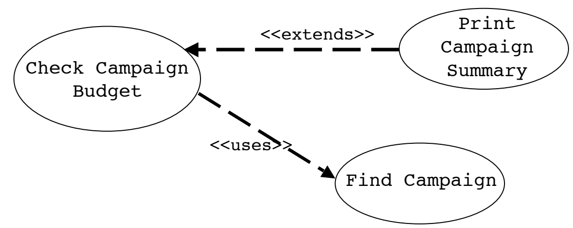


Example

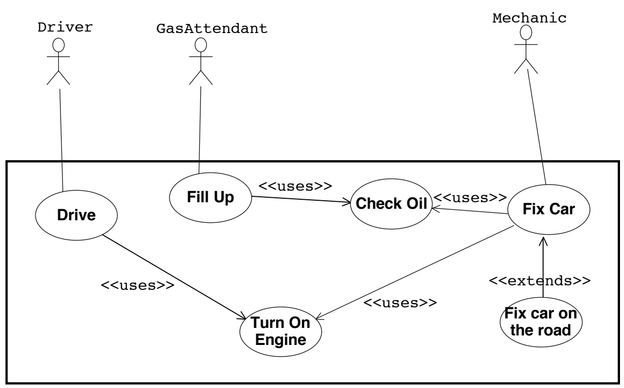


<<extends>> and <<uses>>

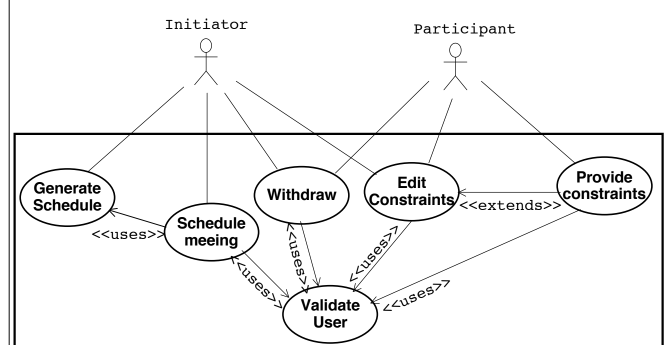
- <<extends>> when one use case adds behaviour to a base case
  - used to model a part of a use case that the user may see as optional system behavior;
  - also models a separate sub-case which is executed conditionally.
- <<uses>>: one use case invokes another (like a procedure call);
  - used to avoid describing the same flow of events several times
  - puts the common behavior in a use case of its own.



Sample use cases for a car



Meeting Scheduler Example



Identifying Actors

→ **Ask the following questions:**
- Who will be a primary user of the system? (primary actor)
- Who will need support from the system to do her daily tasks?
- Who will maintain, administrate, keep the system working? (secondary actor)
- Which hardware devices does the system need?
- With which other systems does the system need to interact with?
- Who or what has an interest in the results that the system produces ?

→ **Look for:**
- the users who directly use the system
- also others who need services from the system

Finding Use Cases

→ **For each actor, ask the following questions:**
- Which functions does the actor require from the system?
- What does the actor need to do ?
- Does the actor need to read, create, destroy, modify, or store some kinds of information in the system ?
- Does the actor have to be notified about events in the system?
- Does the actor need to notify the system about something?
- What do those events require in terms of system functionality?
- Could the actor's daily work be simplified or made more efficient through new functions provided by the system?

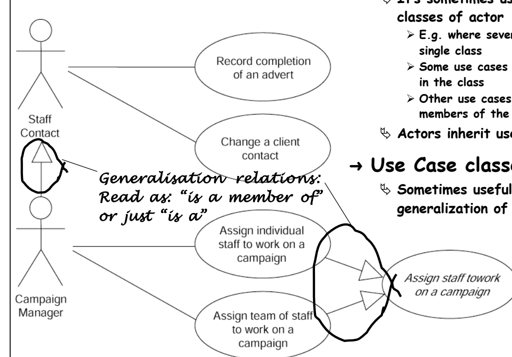
Documenting Use Cases

→ **For each use case:**
- prepare a "flow of events" document, written from an actor's point of view.
- describe what the system must provide to the actor when the use case is executed.

→ **Typical contents**
- How the use case starts and ends;
- Normal flow of events;
- Alternate flow of events;
- Exceptional flow of events;

→ **Documentation style:**
- Choice of how to represent the use case:
  - English language description
  - Collaboration Diagrams
  - Sequence Diagrams

Generalizations



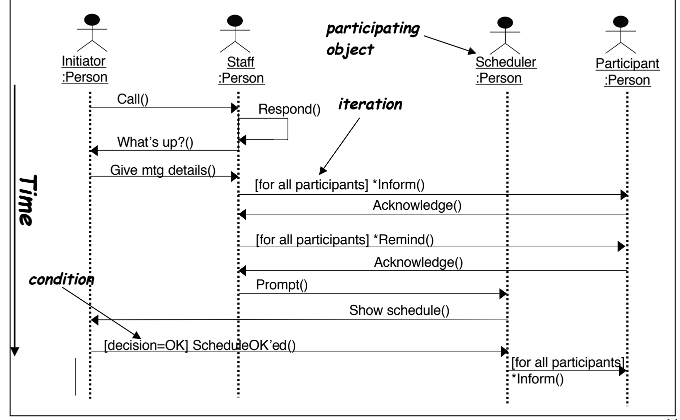
→ **Actor classes**
- It's sometimes useful to identify classes of actor
  - E.g. where several actors belong to a single class
  - Some use cases are needed by all members in the class
  - Other use cases are only needed by some members of the class
- Actors inherit use cases from the class

→ **Use Case classes**
- Sometimes useful to identify a generalization of several use cases

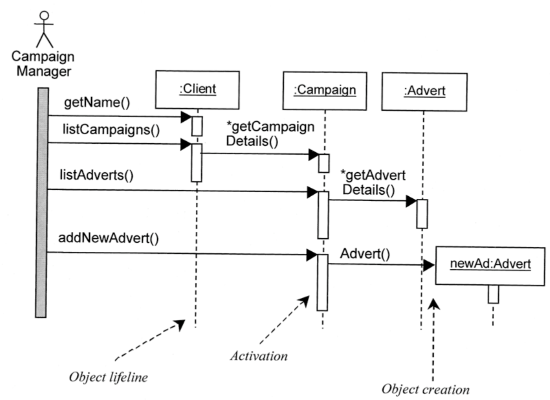
Modelling Sequences of Events

- **Objects "own" information and behaviour**
  - they have attributes and operations relevant to their *responsibilities*.
  - They don't "know" about other objects' information, but can ask for it.
  - To carry out business processes, objects have to collaborate.
    - …by sending messages to one another to invoke each others' operations
  - Objects can only send messages to one another if they "know" each other
    - I.e. if there is an association between them.
- **Describe a Use Case using Sequence Diagrams**
  - Sequence diagrams show step-by-step what's involved in a use case
    - Which objects are relevant to the use case
    - How those objects participate in the function
  - You may need several sequence diagrams to describe a single use case.
    - Each sequence diagram describes one possible scenario for the use case
  - Sequence diagrams…
    - …should remain easy to read and understand.
    - …do not include complex control logic

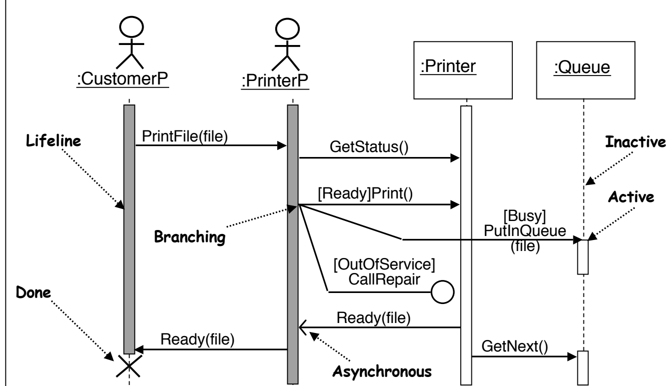
Example Sequence Diagram



Another Example



Branching messages, etc



Don't forget what we're modelling

- **During analysis**
  - we want to know about the application domain and the requirements
  - ...so we develop a course-grained model to show where responsibilities are, and how objects interact
    - Our models show a message being passed, but we don't worry too much about the contents of each message
    - To keep things clear, use icons to represent external objects and actors, and boxes to represent system objects.
- **During design**
  - we want to say how the software should work
  - ... so we develop fine-grained models to show exactly what will happen when the system runs
    - E.g. show the precise details of each method call.