Lecture 13: From Requirements to Design

- Identifying Actors
- Building a Domain Model
- Goal modeling
- Obstacle Analysis
- Scoping
- Use Cases

What do Requirements Analysts do?

Starting point

- Some notion that there is a "problem" that needs solving
  - e.g. dissatisfaction with the current system
  - e.g. a new business opportunity
  - e.g. a potential saving of cost, time, resource usage, etc.
- A Requirements Analyst is an agent of change

The requirements analyst must:

- identify the "problem" / "opportunity"
  - Which problem needs to be solved? (identify problem **Boundaries**)
  - Where is the problem? (understand the **Context**/Problem Domain)
  - Whose problem is it? (identify **Stakeholders**)
  - Why does it need solving? (identify the stakeholders' **Goals**)
  - When does it need solving? (identify Development **Constraints**)
  - What might prevent us solving it? (identify **Feasibility** and **Risk**)
  - How might a software system help? (collect some **Scenarios / Use Cases**)

Refesher

Domain Properties (assumptions):

things in the application domain that are true whether or not we ever build the proposed system

(System) Requirements:

things in the application domain that we wish to be made true by delivering the proposed system

Many of which will involve phenomena the machine has no access to

A (Software) Specification:

is a description of the behaviours that the program must have in order to meet the requirements

Can only be written in terms of shared phenomena!

Starting Point

Given:

a vague request for a new feature from users of your software

1. **Identify the problem**
   - what is the goal of the project?
   - the "vision" of those who are pushing for it?

   ← stakeholder goal modeling & domain models
2. **Scope the problem**
   - Given the vision, how much do we tackle?
   - What new functionality will be needed?
3. **Identify solution scenarios**
   - Given the problem, how will users interact with the software to solve it?

   ← use cases
4. **Map onto the Architecture**
   - How will the needed functionality be met?
   - What new modules / classes will be needed?

   ← robustness analysis

Identifying Actors

Ask the following questions:

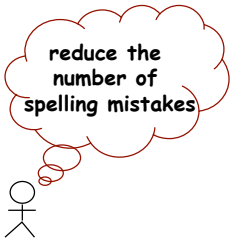
- Who will be a primary user of the system? (primary actor)
  - Who will need support from the system to do her daily tasks?
  - Who or what has an interest in the results that the system produces ?
- Who will maintain, administrate, keep the system working? (secondary actor)
- Which hardware devices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

Look for:

- the users who directly use the system
- also others who need services from the system

Key distinctions

A requirement (goal)



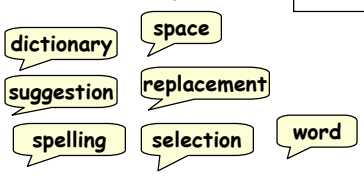
Functions

- identify complete word
- highlight misspellings
- suggest words from dictionary
- pop up a menu

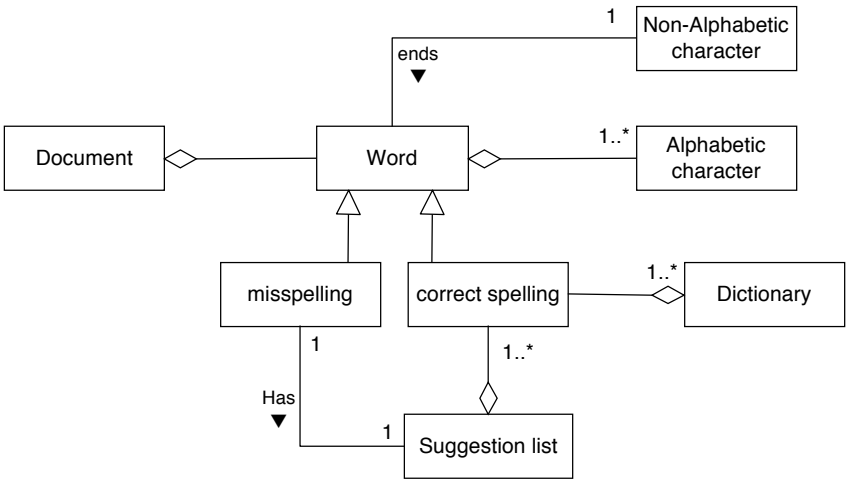
A Use Case

The user types text as usual. When the user completes each word, the system looks it up in the dictionary. If it is not in the dictionary, the word is underlined in red. The user can click on any underlined word, to see a popup menu of suggested alternatives. Clicking any of these alternatives causes it to replace the original word.

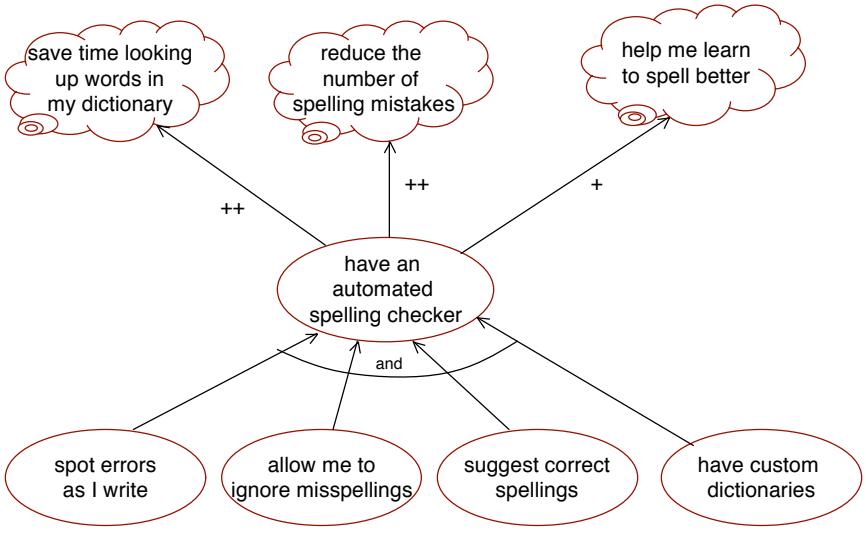
Domain Concepts



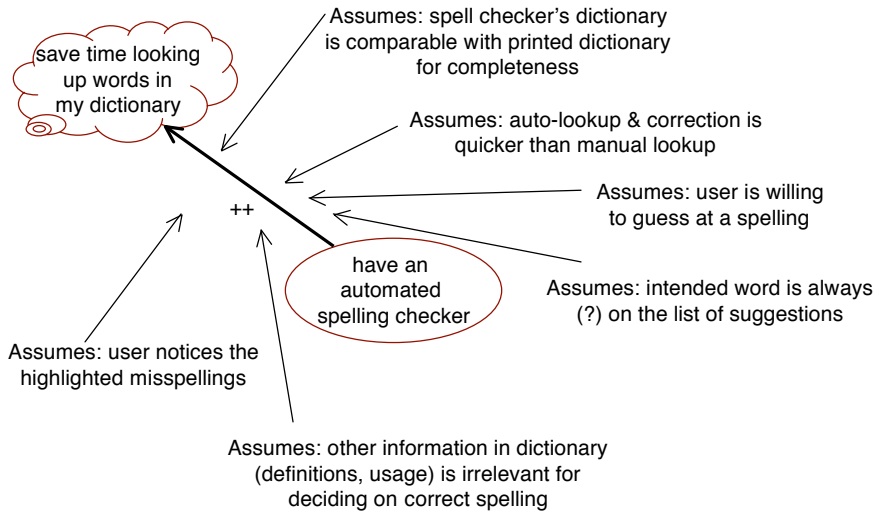
Domain Model



Exploring Goals



Obstacle Analysis



Additional Requirements

"Functional Requirements"

- (?) User can see definitions for suggested spellings
- ability to add custom dictionaries
- ability to add new words to a custom dictionary
- ability to declare certain words to be ignored for spell checking for the current document

"Quality Requirements"

- Dictionary should be as comprehensive as printed dictionaries
- Checking and suggesting should be fast
- Highlighted misspellings must be clearly visible

Scoping decision I

Decide the scope of the problem:

- E.g. Bookstore example:
  - "Textbooks are often not ordered in time for the start of classes"
- But that's just a symptom. (So you ask the manager "why?")
  - "Because we don't receive the booklists from instructors early enough"
- Is that just a symptom of some other problem? (...so ask the instructors "why?")
  - "Because the instructors aren't allocated to courses early enough"
- Is that just a symptom of some other problem? (...so ask the UG office "why?")
  - "Because we never know who's available to teach until the last minute"
- Is that just a symptom of some other problem? (...so ask the dept chair "why?")
  - "Because there's always uncertainty about who gets hired, sabbaticals, etc."
- Is that just a symptom of some other problem? (...so ask the dept chair "why?")
  - "Because instructors we want to hire don't accept our offers early enough"
- Is that just a symptom of some other problem? (...so ask the new recruits "why?")
  - "Because some other universities seem to wait for ages before making offers"
- Is that just a symptom of some other problem? (...so ask U of Waterloo, etc, "why?")
  - "Because it takes our department a long time to reach consensus on hiring"
- Is that just a... ...oh wait... ...maybe we can develop a decision support system for faculty hiring at U of Waterloo, and that will help us get our textbooks for the start of class...

How to scope the problem

Difficulty:

- Every problem can be seen as as symptom of some other (larger) problem
- You can keep on tracing root causes forever if you're not careful

Approach: (...ask yourself these questions...)

- Is there a reasonable expectation that this problem can be solved?
  - (...independently of the larger problem?)
- Is there a reasonable expectation that solving this problem will help?
  - (...without also solving the larger problem?)
- Is this a problem that the stakeholders want solved?
  - (do the "local experts" think this problem is the one that matters?)
- Is this a problem that someone will pay you to solve?
  - (Hint: a feasibility study should quantify the return on investment)

Scoping Decision II

Decide the scope of the solution

- Say you decided that *delay in processing booklists from instructors* is the right level of problem to tackle.
  - "So, let's computerize the submission of textbook forms from instructors"
- But while we're at it:
  - "it would help if we also computerized the submission of orders to the publishers"
- …and of course:
  - "we ought to computerize the management of book inventories too, so we can quickly check stock levels before ordering new books"
- …and in that case:
  - "we might as well computerize the archives of past years booklists so that we can predict demand better"
- …and therefore:
  - "it would also make sense to provide a computerized used book exchange, because that has a big effect on demand for new books"
- …and then of course there's … oh, wait, this is going to cost millions!
  - Bookstore manager: "tell me again how this automated used book exchange will help me order books faster?"

How to scope the solution

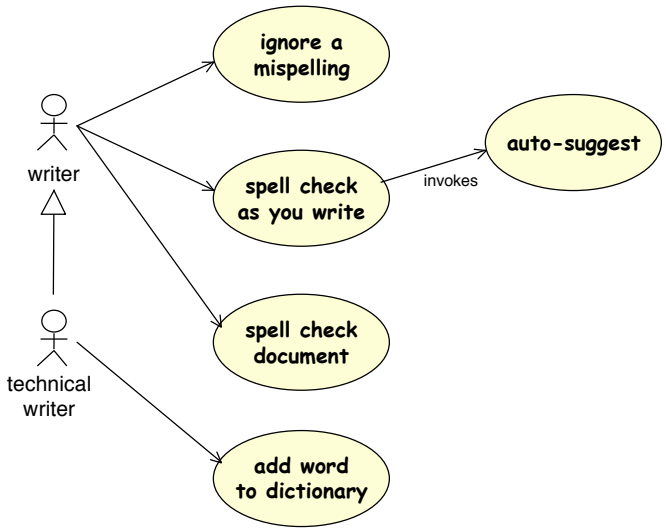
Difficulty:

- We could keep on throwing more technology at the problem forever
- It's hard to decide when to stop adding extra "bells and whistles"

Approach (…select among alternatives carefully…)

- Is there a reasonable expectation that this alternative can be implemented?
  - (…independently of all the other options?)
- Is there a reasonable expectation that implementing this alternative will (help to) solve the original problem?
  - (…without also having to address other aspects of the problem?)
- Is this a solution that the stakeholders can live with?
  - (do the "local experts" think they would use all these functions?)
- Is this a solution that someone will pay you to build?
  - (Hint: a feasibility study should quantify the return on investment for each alternative)

Use Case Diagram



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
  - Activity Diagrams - good for business process
  - Collaboration Diagrams - good for high level design
  - Sequence Diagrams - good for detailed design

Sample Use Case documentation

Name: Place Order

Precondition: A valid user has logged into the system.

Description:

1. The use case starts when the customer selects Place Order.
2. The customer enters his or her name and address.
3. If the customer enters only the zip code, the system will supply the city & state.
4. The customer will enter product codes for the desired products.
5. The system will supply a product description and price for each item.
6. The system will keep a running total of items ordered as they are entered.
7. The customer will enter credit card payment information.
8. The customer will select Submit.
9. The system will verify the information, save the order as pending, and forward payment information to the accounting system.
10. When payment is confirmed, the order is marked Confirmed, an order ID is returned to the customer, and the use case ends.

Exceptions:

In step 9, if any information is incorrect, the system will prompt the customer to correct the information.

Postcondition: The order has been saved in the system and marked confirmed.

ICONIX process