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Chapter 6

Identifying Needs and Establishing Requirements

B.Tech CSBS
VII Semester

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Outline

1. What, How and Why requirements?
2. Data Gathering
3. Data Interpretation and Analysis
4. Task Description
5. Task Analysis

What, how and why?

- What are we trying to achieve in this design activity?
- How can we achieve this?
- Why bother? The importance of getting it right?
- Why establish requirements?

What are we trying to achieve in this design activity?

- Aim is to
  - Identify needs
    - Understand as much as possible about
      - Users
      - Their work
      - Context of the work
  - Produce set of stable requirements
    - To move forward into thinking about design

How can we achieve this?

- At the beginning of requirements activity
  - We have a lot to find out and to clarify

- At the end of activity
  - We will have set of stable requirements to be moved forward into design activity

- In the middle there are activities like
  - Gathering data
  - Interpreting/analyzing the data
  - Capturing the findings in a form that can be expressed as requirements

- Activities follow in a sequential manner

- Identifying needs and establishing requirements is an iterative activity

Why bother? The importance of getting it right

- If requirements are wrong
  - The implications for both producer and consumer are serious
    - Anxiety and frustration
    - Lost revenue
    - Loss of customer confidence
- Taking a user-centered approach to development is one way to address this
  - End result meet users' needs and expectations

Why establish requirements?

- The activity of understanding what a product should do has been given various labels
  - Requirements gathering
  - Requirements capture
  - Requirements elicitation
  - Requirements analysis
  - Requirements engineering

- Requirements gathering
- Requirements capture
  - Imply requirements exist out there
  - We simply need to pick them up
- Requirements elicitation
  - Implies others know the requirements
  - We have to get them to tell us

- Requirements analysis
  - Describe the activity of investigating and analyzing initial set of requirements
    - Gathered
    - Elicited
    - Captured
  - Interpretation of facts

- Requirements Engineering
  - Better term than others
    - It recognizes
      - developing set of requirements is an iterative process, involves
        - Evolution
        - Negotiation
    - Requirements are carefully managed and controlled

What are requirements?

- Requirement is a statement about an intended product that specifies
  - What it should do?
  - How it should perform?
- Aims of requirement activity is to make requirements
  - Specific
  - Unambiguous
  - clear
- Eg: requirement for a website
  - Time to download any complete page is less than 5 seconds

Requirement #: 75 Requirement Type: 9 Eventluse case #: 6

Description: The product shall issue an alert if a weather station fails to transmit readings.

Rationale: Failure to transmit readings might indicate that the weather station is faulty and needs maintenance, and that the data used to predict freezing roads may be incomplete.

Source: Road Engineers
Fit Criterion: For each weather station the product shall communicate to the user when the recorded number of each type of reading per hour is not within the manufacturer's specified range of the expected number of readings per hour.

Customer Satisfaction: 3 Customer Dissatisfaction: 5

Dependencies: None Conflicts: None

Supporting Materials: Specification of Rosa Weather Station

History: Raised by GBS, 28 July 99

Volere

Figure 7.1 An example requirement using the Volere template.*

Different kinds of requirements

- Two kinds of requirements in S/E
  - Functional Requirements
    - What the system should do
  - Non-functional Requirements
    - Constraints on the system and its development
- Eg: Word processor
  - Functional Requirement: Variety of formatting styles (bold, italic, underline)
  - Non-functional Requirement: must run on a variety of platforms (Mac, Unix machines)

- Non-functional requirements of interaction devices include
  - Physical size
  - Weight
  - Color
  - Production feasibility

- Interaction design requires us to understand
  - Functionality required
  - Constraints under which the product must operate/developed
- Variety of requirements of interaction devices
  - Functional requirements
  - Data requirements
  - Environmental requirements
  - User requirements
  - Usability requirements

- Functional requirements
  - Captures what the product should do
    - Eg: Smart Fridge
      - Smart fridge might be able to tell when the butter tray is empty

- Data Requirements
  - Captures the
    - Type
    - Volatility
    - Size/amount
    - Persistence
    - Accuracy
    - Value of the amounts of the required data
  - Interactive devices have to handle greater/lesser amounts of data
  - Eg: personal banking domain
    - Data must be accurate
    - Must persist over many months and years

- Environmental requirements/context of use
  - Refer to circumstances in which the interactive product is operated
  - Four aspects of environments should be considered
    - Physical environment
    - Social environment
    - Organizational environment
    - Technical environment

  - Physical environment
    - How much
      - Lighting
      - Noise
      - Dust
        - is expected in the operational environment
    - Eg:
      - Will use of gloves might affect the choice of interaction paradigm?
      - ATM operates in public environment, using speech to interact is problematic

- Social environment
  - Regards social aspects of the interaction design
  - Collaboration and coordination need to be explored
  - Eg:
    - Do collaborators have to communicate across great distances?
    - Will data need to be shared?
      - If so, sharing have to be synchronous/asynchronous
- Organizational environment
  - Eg:
    - How good is user support likely to be?
    - How easily can it be obtained?
    - Are there facilities/resources for training?
    - How efficient or stable is the communications infrastructure?
    - How hierarchical is the management?
- Technical environment
  - Eg:
    - what technologies will the product run on/need to be compatible with?
    - What technological limitations might be relevant?

- User requirements
  - Capture
    - the characteristics of the intended user group
    - User's abilities and skills
    - User may be
      - Novice
      - Expert
      - Casual
      - Frequent user
  - The collection of attributes for a typical user is called 'user profile'
    - A device may have a number of different user profiles

- Usability requirements
  - Capture
    - the usability goals
    - associated measures for a particular product
  - Other kinds of requirements we must establish

Data Gathering

- Important part of requirements activity and evaluation

- Purpose is to collect
  - Sufficient
  - Relevant
  - Appropriate data
    - To produce stable requirements

- If a set of initial requirements exists, data gathering is required to
  - Expand
  - Clarify
  - Confirm initial requirements

Data Gathering Techniques

- Questionnaires
- Interviews
- Focus groups and workshops
- Naturalistic observation
- Studying documentation

- Questionnaires

  - Series of questions designed to elicit specific information from user
    - simple YES/NO
    - to choose from a set of pre-supplied answers
    - long response or comment

  - Sometimes
    - may sent
      - In electronic form
      - arrive via email
      - Posted on a website
    - Given on paper

  - Administered at a distance
    - No one will help to answer
    - Explain what they mean

UKMi
UK Medicines Information

User Survey Questionnaire of the Medicines Information Service

Centre: _____ **Enquiry No:** _____

Title: _____

Please complete the following questionnaire with specific regard to the [X] above enquiry, by placing a CROSS in the appropriate box

	strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1. Initially I was able to contact the service easily	☐	☐	☐	☐	☐
2. I was informed when I could expect an answer	☐	☐	☐	☐	☐
3. The answer provided was sufficiently detailed for my needs	☐	☐	☐	☐	☐
4. In general I found the service to be helpful	☐	☐	☐	☐	☐
5. I had to contact the MI centre more than once before I received a response	☐	☐	☐	☐	☐
6. I received the answer to my enquiry too late for it to be useful	☐	☐	☐	☐	☐
7. The information was received when requested	☐	☐	☐	☐	☐
8. I did not receive the information that I required	☐	☐	☐	☐	☐
9. I received the answer to my enquiry within the time requested	☐	☐	☐	☐	☐
10. I was happy with the answer to my question	☐	☐	☐	☐	☐
11. My question was answered in full	☐	☐	☐	☐	☐

- Well-designed questionnaires are good at
  - Getting answers to specific questions from
    - Large group of people
      - Spread across a wide geographical area
      - Making it infeasible to visit them all
- Often used in conjunction with other techniques
  - Eg:
    - Information obtained from interview may be verified by sending a questionnaire

- Interviews
  - Asking someone a set of questions
  - Often face-to-face, but don't have to be always
  - Companies spend large amounts of money conducting telephone interviews
    - To find
      - What customer like /don't like about their service

  - Can be broadly classified as
    - Structured
    - Unstructured
    - Semi-structured
      - Depending on how rigorously the interviewer sticks to a prepared set of questions

  - in the context of establishing requirements,
    - Development team meet stakeholders for users to feel involved
    - Sufficient motivation to arrange interviews

  - Time consuming & may not visit all people you'd like to see

- Focus groups and workshops

  - Interviews
    - tend to be one on one
    - Elicit only one person's perspective
  - Group of stakeholders get together to discuss
    - Issues
    - Requirements
  - Sessions can be structured/unstructured
    - In case of unstructured sessions
      - Facilitator
        - keeps the discussion on track
        - Provides necessary focus/redirection when appropriate
  - Workshops in JAD are very structured
    - Contents and participants are all prescribed

- Focus groups and workshops

  - Good at
    - gaining consensus on requirements
    - Highlighting areas of conflict and disagreement

  - Helps
    - Stakeholders
      - meet designers
      - Express their views in public

  - Uncommon for stakeholders unaware of the views of other stakeholders in the company

  - sessions need to be structured carefully & participants need to be chosen carefully
    - Coz
      - Few people dominate discussions
        - Control, impose/influence over other participants

- Naturalistic observation

  - Very difficult for humans to explain
    - What they do
    - Accurately how they achieve a task

  - Spending some time with stakeholders
    - To learn day-to-day tasks
    - Observing work as it happens
      - In its natural setting

  - A member of the design team
    - shadows a stakeholder
      - Making notes
      - Asking questions
      - Observing what is being done

  - Requires more time and commitment from a member of the design team

- Studying documentation

  - Procedures and rules are often written down in manuals

  - Good for understanding legislation and getting some background information on the work

  - Good source of data about
    - steps involved in the activity
    - Any regulations governing a task

  - Other documentation includes
    - Diaries
    - Job logs
      - Written by stakeholders during the course of the work

  - Doesn't involve stakeholder time
    - A limiting factor in other techniques

Table 7.1 Overview of data-gathering techniques used in the requirements activity

Technique	Good for	Kind of data	Advantages	Disadvantages	Detail for designing in
Questionnaires	Answering specific questions	Quantitative and qualitative data	Can reach many people with low resource	The design is crucial. Response rate may be low. Responses may not be what you want	Chapter 13
Interviews	Exploring issues	Some quantitative but mostly qualitative data	Interviewer can guide interviewee if necessary. Encourages contact between developers and users	Time consuming. Artificial environment may intimidate interviewee	Chapter 13
Focus groups and workshops	Collecting multiple viewpoints	Some quantitative but mostly qualitative data	Highlights areas of consensus and conflict. Encourages contact between developers and users	Possibility of dominant characters	Chapter 13
Naturalistic observation	Understanding context of user activity	Qualitative	Observing actual work gives insights that other techniques can't give	Very time consuming. Huge amounts of data	Chapter 12
Studying documentation	Learning about procedures, regulations and standards	Quantitative	No time commitment from users required	Day-to-day working will differ from documented procedures	**N/A**

Choosing between techniques

- At the beginning you may not have any specific questions that need answering
  - Spend time exploring issues through interviews than questionnaires

- Resources available influence your choice
  - Eg:
    - Sending out questionnaires nationwide requires sufficient time, money and people
      - Try it out
      - Issue it
      - Collate the results
      - Analyze them
    - If you have only 3 weeks and no one on the team has designed a survey before
      - This is unlikely to a success

- Location and accessibility of the stakeholders to be considered
  - Run a workshop for a large group of stakeholders, but if they are spread across wide area, is unlikely to be practical

- Data gathering techniques rests on two issues
  - Nature of data gathering technique itself
  - Task to be studied

  - Data gathering techniques differ in two main respects
    - Amount of time, level of detail and risk associated with the findings
      - Naturalistic observation
        - Will take two days of effort and three months of training
      - Interviews
        - One day of effort and one month of training
    - The knowledge the analyst must have about basic cognitive processes

- Tasks can be classified along three scales
  - Is the task a set of sequential steps/rapidly overlapping series of subtasks?
  - Does the task involve
    - high information content with complex visual displays
    - low information content with simple signals to alert the user
  - Is the task intended to be performed by
    - a layman without much training
    - practitioner skilled in the task domain?

BOX 7.4 Coordinated Methods *(Olson and Moran, 1996)*

For a walk-up-and-use system. An ATM is an example of a system with a simple task flow and relatively low information content that is targeted for the layman. Because of the user base, the emphasis will be on the ease with which the user can learn to operate the device. An understanding of the user's mental model may also yield insights, as evidenced by the assignment set at the end of Chapter 3.

To establish the components of the task, simple questionnaires might suffice, supplemented with naturalistic observation, i.e., observing current users at existing machines. The initial design guided by guidelines and checklists could be documented as a storyboard. A mockup of the entire system using a rapid prototyping system such as Visual Basic can be used to observe users' difficulties. After a series of such prototyping sessions, the system could be installed in a friendly site and logging data could be gathered.

For a high-performance system. The example used here is a system to support back-room workers at a bank who are reconciling the machine register with the information written on the back of the deposit slip by the customer. The task requires overlapping activation of physical actions and mental capabilities, is relatively high in information content, and is targeted for a skilled user.

This task is less obvious to the designer and we need to employ several techniques to understand it. If there is an existing system in place, then naturalistic observation and interview can be used. More detailed discovery of the objects, actions, and kinds of thinking can come from using interviews. Task analysis will help to understand the details of the task, and once understood, a series of design and evaluation steps follow, including prototyping, detailed analysis of the visual display and usability tests. The design would then iterate until it meets preset target criteria.

Basic data-gathering guidelines

- Focus on identifying stakeholder's needs
  - Achieved by
    - Existing behavior
    - Support tools
    - Looking at other products
      - Competitor's product
      - Earlier release of your product under development
- Involve all stakeholder groups
- Involving only one representative from each stakeholder group is not enough, especially if the group is large
- Use a combination of data gathering techniques
- Support the data-gathering sessions with suitable props, such as task descriptions and prototypes if available
- Run a pilot session if possible to ensure that your data-gathering session is likely to go as planned

- understand
  - what you are looking for
  - what kinds of analysis you want to do,
  - design the data-capture exercise to collect the data you want

- How you record the data during a face-to-face data-gathering session is just as important as the technique(s) you use.
  - Video recording, audio recording, and note taking are the main options

Data Interpretation and Analysis

- Aim is to
  - Structure the descriptions of requirements
  - Template such as Volere
    - Highlights information about the requirement
    - Guides data interpretation and analysis
    - Entries are concerned with traceability
      - Who raised the requirement
      - Where can more information about it be found
    - Information may be captured in documents/diagrams

Requirement #: Unique *Id* Requirement Type: **Template section** Event/use case #: **Origin of the requirement**

Description: **A one-sentence statement of the intention of the requirement**

Rationale: Why **is the requirement considered important or necessary?**

Source: Who **raised this requirement?**

Fit Criterion: **A quantification of the requirement used to determine whether the solution meets the requirement.**

Customer Satisfaction: **Measures the desire to have the requirement implemented** Customer Dissatisfaction: **Unhappiness if it is not implemented**

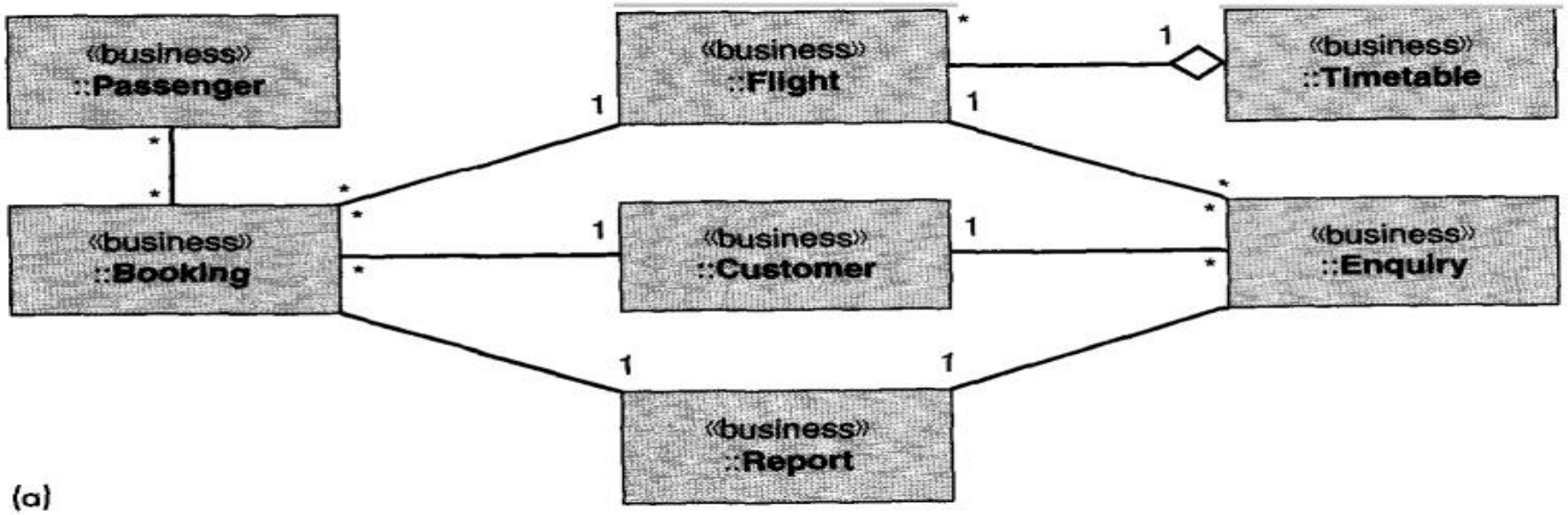
Dependencies: **Other requirements with a change effect** Conflicts: **Requirements that contradict this one**

Supporting Materials: **Pointer to supporting information**

History: **Origin** and **changes to the requirement**

Volere

- Different techniques and notations exist for investigating
  - different aspect of the system
  - Give rise to the different requirements
    - Functional requirements - Data-flow diagrams/state charts/work-flow charts etc.,
    - Data Requirements – entity relationship diagrams
      - If OO approach
        - Functional and data requirements are combined into class diagrams
        - With behavior expressed in state charts and sequence of diagrams



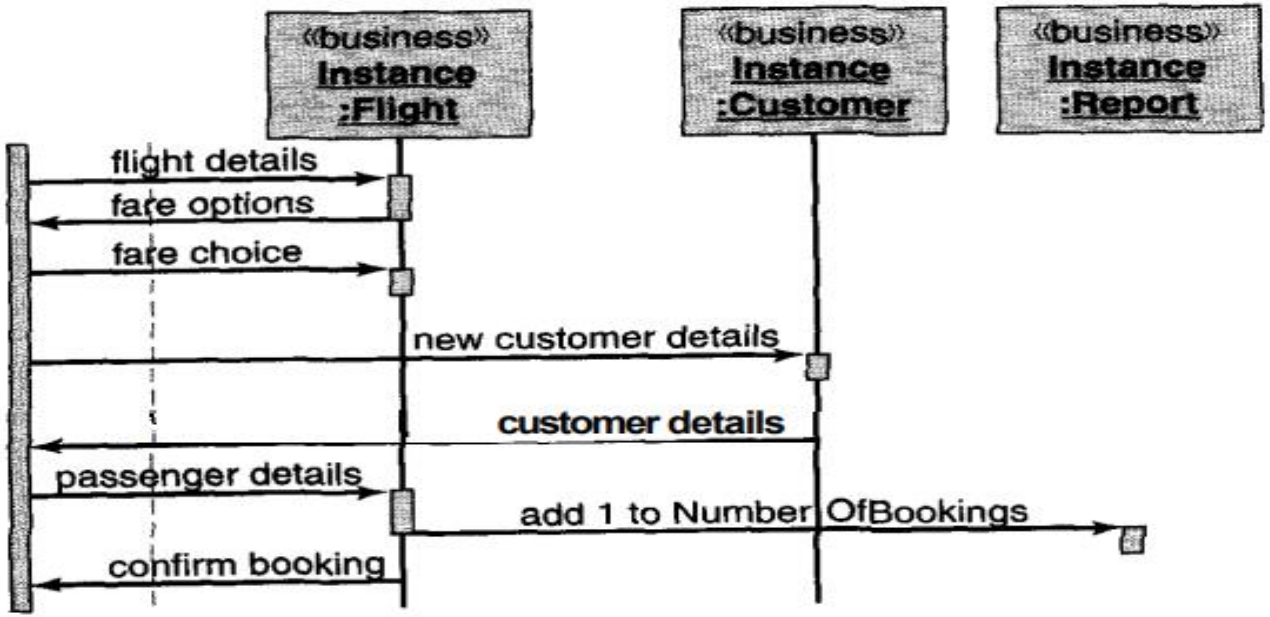
(a)

(b)

Book Flight

Description

Flight details entered
Fare option displayed
Fare chosen
If new customer
    Enter details
End If
Display customer details
Passenger details entered
Add 1 to NumberOfBookings
Booking confirmed by email



- Four techniques to
  - Have user-centered focus
  - Understand users' goals and tasks
    - Scenarios
    - Use cases
    - Essential use cases
    - Task analysis
      - All of them may be produced during data-gathering sessions
- Requirements activity iterates a number of times before a set of stable requirements evolves

Task Description

- Description of business tasks
- Three different flavors of task descriptions
  - Scenarios
  - Use cases
  - Essential use cases

Scenarios

- Informal narrative description
  - Describes
    - Human activities and tasks in a story
  - Allows exploration and discussion
    - Contexts
    - Needs
    - requirements

A scenario that might be generated by potential users of a library catalog service is given below:

Say I want to find a book by George Jeffries. I don't remember the title but I know it was published before ***1995****. I go to the catalog and enter my user password. I don't understand why I have to do this, since I can't get into the library to use the catalog without passing through security gates. However, once my password has been confirmed, I am given a choice of searching by author or by date, but not the combination of author and date. I tend to choose the author option because the date search usually identifies too many entries. After about 30 seconds the catalog returns saying that there are no entries for George Jeffries and showing me the list of entries closest to the one I've sought. When I see the list, I realize that in fact I got the author's first name wrong and it's Gregory, not George. I choose the entry I want and the system displays the location to tell me where to* ***find*** *the book.*

- Scenarios
  - Generated during workshop/interview sessions
    - Explains/discusses
      - User’s goals

Use cases

- Captures user-system interaction
  - Than user's task
- Ordered sequence of scenario
- Has
  - Primary flow
  - Second flow

Comment

One other main actor is the "Librarian." **A** use case for the "Librarian" would be "Update catalog." Figure 7.9 is the associated use case diagram. There are other use cases you may have identified.

The use case for "**Locate** book" might be something like this:

1. The system prompts for user name and password.

2. The user enters his or her user name and password into the catalog system.

3. The system verifies the user's password.

4. The system displays a menu of choices.

5. The user chooses the search option.

6. The system displays the search menu.

7. The user chooses to search by author.

8. The system displays the search author screen.

9. The user enters the author's name.

10. The system displays search results.

11. The user chooses the required book.

12. The system displays details of chosen book.

13. The user notes location.

14. The user quits catalog system.

Alternative courses:

4. If user password is not valid
4.1 The system displays error message.
4.2 The system returns to step **1.**

5. If user knows the book details
5.1 The user chooses to enter book details.
5.2 The system displays book details screen.
5.3 The user enters book details.
5.4 The system goes to step **12.**

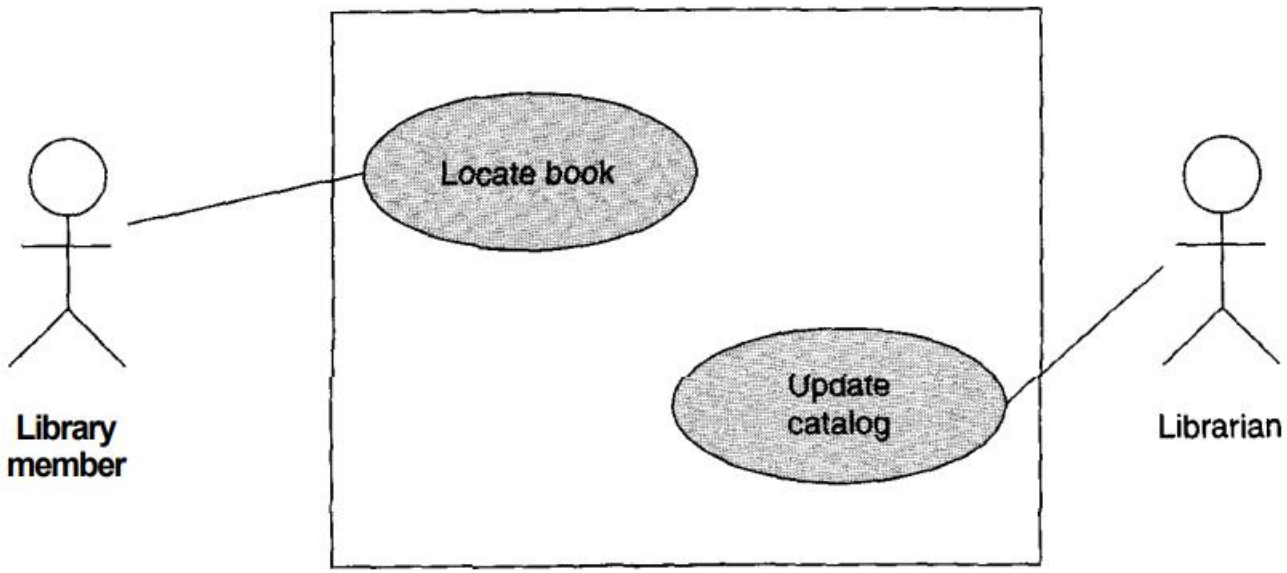


Figure 7.9 Use case diagram for the library catalog service.

Essential Use cases

- Developed by Constantine
- Represent abstraction from scenarios
- Essential use case consists of three parts
  - Name that expresses overall user intention
  - Stepped description of user actions
  - Stepped description system responsibility

locateBook

USER INTENTION	SYSTEM RESPONSIBILITY
identify self	
	verify identity
	request appropriate details
offer known details	
	offer search results
note search results	
quit system	
	close

Note that here we don't talk about passwords, but merely state that the users need to identify themselves. This could be done using fingerprinting, or retinal scanning, or any other suitable technology. The essential use case does not commit us to technology at this point. Neither does it specify search options or details of how to initiate the search.

Task analysis

- Hierarchical task analysis
  - Breaking a task down into subtasks into sub-subtasks and so on

0. In order to borrow a book from the *library*
   1. go to the library
   2. find the required book
      2.1 access library catalog
      2.2 access the search screen
      2.3 enter search criteria
      2.4 identify required book
      2.5 note location
   3. go to correct shelf and retrieve book
   4. take book to checkout counter

plan 0: do **1-3-4.** If book isn't on the shelf expected, do **2-3-4.**
plan 2: do **2.1-2.4-2.5.** If book not identified do **2.2-2.3-2.4-2.5.**

Figure 7.11 An HTA for borrowing a book from the library.

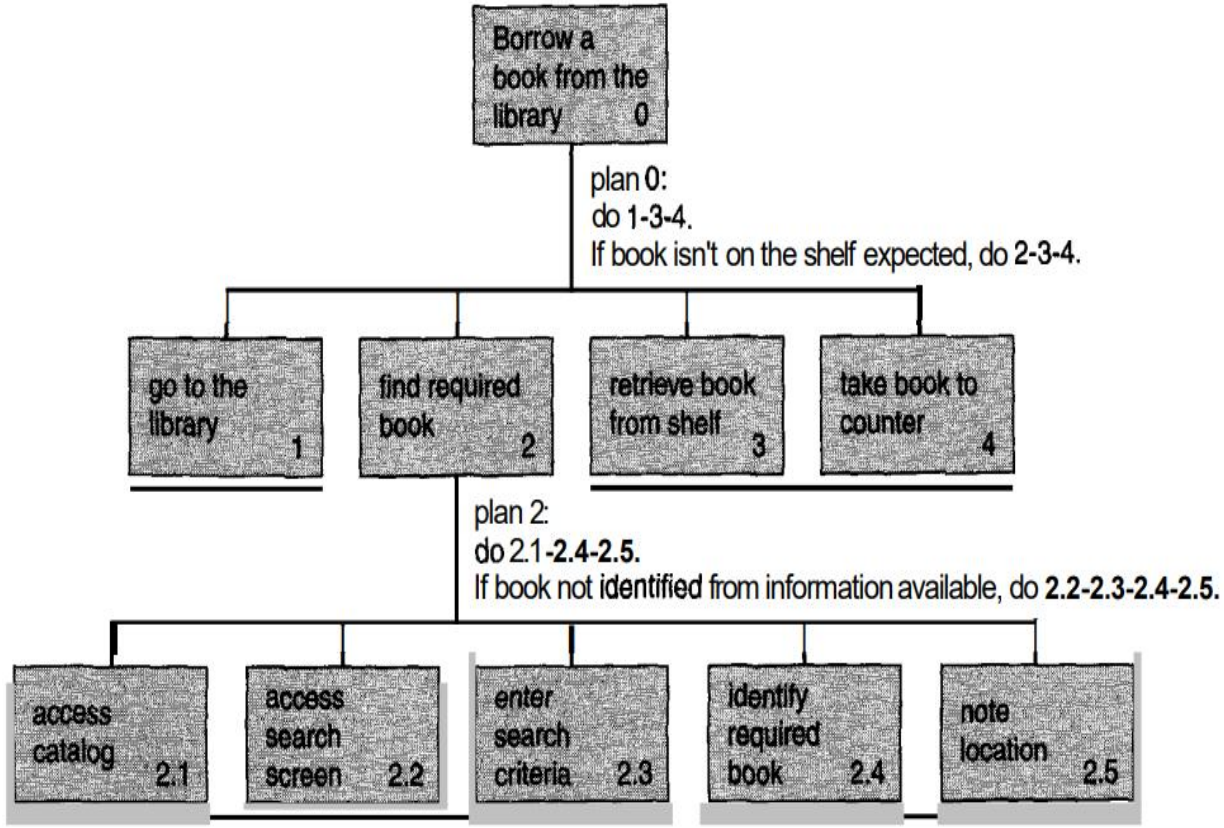


Figure 7.12 A graphical representation of the task analysis for borrowing a book.

THANK YOU