

Identifying Needs and Establishing Requirements

- What, How and Why
- Types of Requirements
- Data Gathering Techniques
- Task Description and Task Analysis

What, How and Why

What is it?

- Find the **needs** of users
- From the users' needs, determine the **requirements** of the proposed system

In more detail, 2 aims in this activity are:

- Understand as much as possible about users, task, context, etc., so that the system under development can support them in achieving their goals
- Produce a stable set of **requirements** that form a sound basis to move forward into thinking about design

“Identifying needs and establishing requirements” is sometimes referred to as “requirements” activity

What, How and Why

How to achieve the aims?

- Data gathering
- Data analysis
- Requirements determination
- All of the above activities is **iterative**

e.g., once you start to analyse your collected data, you may find that you need to gather some more data to clarify some ideas you have

Why we need requirements activity?

- Failure occurs most commonly for “unclear objectives and requirements” while critical success occurs most often for “clear, detailed requirements”, e.g. many Web companies in H.K. do not have clear objectives
- Getting requirements right is crucial

Establishing Requirements

A requirement is a statement about an intended product that specifies **what it should do** or **how it should perform**:

- What do users want?
- What do users 'need'?
- Requirements need clarification, refinement, completion, re-scoping (e.g., Website download time should be short enough, what is "short"? 5 seconds?)
- Input: requirements document (maybe)
- Output: stable requirements

Types of Requirements

Two types:

- **Functional** requirements, i.e., what the system should do?
- **Non-functional** requirements, i.e., what constraints there are on the system and its development, e.g., usability

Taking a word processor as an example:

Functional requirements: Support a variety of formatting styles, e.g., must include 20 typefaces

Non-functional requirements:

- Able to run on different platforms including PCs, Macs and Unix
- Able to run on a PC with a minimum of 64 MB RAM
- The product should be delivered in 6 months' time
- Novices should learn how to use it easily

Types of Requirements

Non-functional requirements can be refined as:

- **Data** requirements: type, size/amount, accuracy, storage, etc., of the required data, e.g., in a share-dealing application domain, the data must be up-to-date and accurate, and is likely to change many times a day
- **Environmental** requirements: circumstances in which the product will be expected to operate
 - **Physical** –lighting, noise, etc. of operational environment
 - **Social** – e.g., collaboration and coordination issues; Will data need to be shared? Do collaborators have to communicate across great distances?
 - **Organizational** – e.g., hierarchy of the management, user support, facilities or resources for training?
 - **Technical** – e.g., what technologies will the product run on or need to be compatible with?

Types of Requirements

- **User** requirements: The characteristics of the intended user group, e.g., their abilities and skills, novice/ expert/ infrequent/ frequent user?
e.g., if the user is a frequent user, then it would be important to provide short cuts such as function keys rather than expecting them to type long commands or to have to navigate through a menu structure
- **Usability** requirements (\neq user requirements)

Example: Suppose CityU has proposed a **self-service** café so that users are allowed to pay for their food (bread, sandwiches, drinks) using a credit system, e.g., payment is settled via their CityU or Octopus cards

Suggest one key functional, data, environmental, user and usability requirement for the proposed system.

Types of Requirements

Functional: The system will calculate the total cost of purchases

Data: The system must have access to the prices of all products in the café

Environmental: Café users will be carrying a tray and will most likely be in a reasonable rush. The physical environment will be noisy and busy, and users may be talking with friends and colleagues while using the system

User: The majority of users are likely to be under 25 and comfortable when dealing with technology

Usability: The system needs to be simple so that new users can use the system immediately, and memorable for more frequent users. Users will not want to wait around for the system to finish processing, so it needs to be efficient and to be able to deal easily with user errors.

Data Gathering Techniques

Collect sufficient, relevant and appropriate data for establishing user requirements (for **evaluation** as well)

Four key issues are:

- Setting goals
 - Decide how to analyze data once collected
- Relationship with participants
 - Clear and professional
 - Informed consent when appropriate
- Triangulation
 - Use more than one approach
- Pilot studies
 - Small trial of main study

Data Gathering Techniques

Data can be recorded using – notes, audio, video, photograph, computer logging

- **Notes**: cheap but limited to writing speed
- **Audio**: cheap, difficult to match with other protocols (cannot record some actions)
- **Video**: accurate, needs special equipment, the user may feel uncomfortable (obtrusive)
- **Computer logging**: automatic & unobtrusive, difficult to analyze for large amounts of data

Data Gathering Techniques

Commonly used techniques:

1. Questionnaires

- A series of questions designed to elicit specific information
- Questions may require different kinds of answers: YES/NO; choice of pre-supplied answers; comment
- Often used in conjunction with other techniques
- Can give quantitative or qualitative data
- Good for answering specific questions from a large, dispersed group of people
- Usually no one is needed to help answer the questions or to explain what they mean

Data Gathering Techniques

- Questions can be closed or open (e.g., What is your gender? Any suggestions on the interface?)
- Closed questions are easiest to analyse, and may be done by computer
- Paper, email & the Web used for dissemination
- Advantage of electronic questionnaires is that data goes into a database & is easy to analyse

Data Gathering Techniques

Questionnaire design:

- The impact of a question can be influenced by question order.
- Do you need different versions of the questionnaire for different populations? (e.g., Offer a short version for those who do not have time to complete a long questionnaire)
- Provide clear instructions on how to complete the questionnaire.
- Strike a balance between using white space and keeping the questionnaire compact.
- Decide on whether phrases will all be positive, all negative or mixed.

Data Gathering Techniques

Questionnaire format:

- 'Yes', 'no' checkboxes that offer one option
- Checkboxes that offer many options
- Likert rating scales (3, 5, 7 & 9 point scales are common)

(1) The use of color is excellent: (where 1 represents strongly agree and 5 represents strongly disagree)

1	2	3	4	5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Semantic scales

Instructions: for each pair of adjectives, place a cross at the point between them that reflects the extent to which you believe the adjectives describe the home page. You should place *only one cross* between the marks on each line.

Attractive  Ugly

- Open-ended responses

Data Gathering Techniques

Web-based questionnaires:

- Start from developing the **paper** version
- Advantages:
 - Responses are usually received quickly
 - No copying and postage costs
 - Data can be collected in database for analysis
 - Time required for data analysis is reduced
 - Errors can be corrected easily
- Disadvantages:
 - Individuals may response more than once
 - Lower response rate than paper questionnaires

Data Gathering Techniques

2. Interviews

- Forum for talking to people: can be face-to-face or telephone interviews
- Involve asking a set of questions:
 - Unstructured - are not directed by a script; Rich but not replicable
 - Structured - tightly scripted, often like a questionnaire; Replicable but may lack richness
 - Semi-structured – guided by a script but interesting issues can be explored in more depth; Can provide a good balance between richness and replicability
- Good for exploring issues
- Time consuming and may be infeasible to visit everyone

Data Gathering Techniques

- Props - devices for prompting interviewee, e.g., a prototype, scenario, can be used to enrich the interview process



Data Gathering Techniques

Interview Questions:

- Two types:
 - 'closed questions' have a predetermined answer format, e.g., 'yes' or 'no'
 - 'open questions' do not have a predetermined format
- Closed questions are easier to analyze
- Avoid:
 - Long questions
 - Compound sentences - split them into two
 - Jargon and language that the interviewee may not understand
 - Leading questions that make assumptions e.g., why do you like ...?

Data Gathering Techniques

Common steps for interview:

- *Introduction* – introduce yourself, explain the goals of the interview, reassure about the ethical issues, ask to record, present an informed consent form (state the purpose of the test, explain the fact that it is being video-recorded, promise confidentiality, etc.)
- *Warm-up* - make first questions easy & non-threatening
- *Main body* – present questions in a logical order
- *Cool-off period* – include a few easy questions to defuse tension at the end
- *Closure* – thank interviewee, signal the end, e.g., switch recorder off

Data Gathering Techniques

A sample Informed Consent form:

Computer Science Curriculum Study

Informed Consent and Privacy Statement

The study in which you are being asked to take part is an evaluation a website for a new textbook. A member of the team that is developing the text is conducting this study.

The general purpose of this study is to get feedback on the course topics and supporting materials during the early stages of development.

Please be informed that you must sign this informed consent before participating in the study. This informed consent document is intended to provide you with general information about the study and to assure you that, as a participant, your privacy will be maintained.

Please also be informed that:

Your participation in the study is fully voluntary. You have the right not to participate, and you will not be penalized in any way if you do not participate.

All information you provide in this study is confidential. Any report of the study results will be used only to evaluate the topics and materials in question.

Other than seeing a preview of the text's subject matter, there is no direct benefit to you. There are also no foreseen risks from participating in this study.

At the completion of the study, you will be given a thorough explanation of the research techniques, possible publication, and impact of the study, if you request it.

By signing this informed consent you certify that you are 18 years of age or older.

Data Gathering Techniques

3. Group interview

- Get a group of stakeholders together for discussion
- Also known as 'focus group' and workshop
- Good at gaining a consensus view and/or highlighting areas of conflict and disagreement
- Typically 3-10 participants
- Provide a diverse range of opinions
- Need to be managed to:
 - Ensure everyone contributes
 - Discussion is not dominated by one person
 - The agenda of topics is covered

Data Gathering Techniques

嘉湖海逸誘空姐租省招牌

奇招引客

市區的服務式住宅愈見受歡迎，長租酒店的需求亦見增長，而位於天水圍的嘉湖海逸酒店更因找中對象，吸引了150位空姐入住，替其月租套房「省靚」招牌。

其總經理徐英略說，7年前酒店開幕時，看到地點不方便，宣傳經費及人力又有限，「必須針對一群為數不少的潛在客人，旨在一擊即中。」結果，酒店選定空姐。

穿梭巴士去機場

「找空姐來做小組訪問（focus group），發現她們對居所的要求是方便去機場、安全，還可以購物。」他表示，酒店遂每小時提供穿梭巴士前往機場，又聘用退役踞喀兵當保安員，「酒店附近有商場方便購物，所以吸引150位空姐入住，佔月租房間約30%。」他還說，酒店約有550個月租套房，現每月平均入住率維持94%至97%。

他透露，酒店月租由5,900元至2.2萬元，住客佔40%為本地人，33%為在港工作的外籍人士，12%為海外華僑，其餘的是商務客及內地遊客。

另方面，該酒店日租客房部分（約550間），也預留5至10%房間，提供1周及2周的長住套餐，分別每晚由435元起及385元起（未連稅項）。徐英略指，這類套餐的住客多數是回港探親人士。

港島香格里拉大酒店發言人也說，自去年起，長租套房需求顯著增長，住客以單身來港的外籍人士居多，「他們較享受酒店環境多過一般住宅。」

■本報記者 黃卓敏

An example of using focus group to collect needs of flight attendants who would like to rent a service apartment
(Hong Kong Economics Times, Nov. 05)

Data Gathering Techniques

4. Direct or indirect observation

- Motivation: it can be difficult for users to explain what they do or describe accurately how they achieve a task
- Spend time with stakeholders in their day-to-day tasks, observing work as it happens in its natural setting
- Gain insights into stakeholders' tasks
- Good for understanding the nature and context of the tasks
- Require time and commitment from a member of the design team, and it can result in a huge amount of data
- Can be passive (listening and watching) or active (asking questions)
- Can include audio/video recording, computer logging and diary studying

Data Gathering Techniques

5. Studying documentation

- Include manuals, regulations, stakeholders' work diaries
- Good for understanding legislation and getting background information on the work
- Good source of data about the steps involved in an activity, and any regulations governing a task
- Not to be used in isolation (e.g., users may not follow the documented work procedures exactly)
- Advantage over other techniques is that it does not involve stakeholder time

6. Research similar products

- Help to generate alternative designs and prompt requirements

Data Gathering Techniques

Technique	Good for	Kind of data	Advantages	Disadvantages
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
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
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
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
Studying documentation	Learning about procedures, regulations and standards	Quantitative	No time commitment from users required	Day-to-day working will differ from documented procedures

Data Gathering Techniques

Some basic guidelines:

- Focus on identifying the stakeholders' needs
- Involve all the stakeholder groups
- Involve sufficiently number of representatives from each stakeholder group
- Use a combination of data gathering techniques
- Support the process with props such as prototypes and task descriptions
- Run a pilot session
- Need to compromise on the data you collect and the analysis to be done due to constraints on resources
⇒ Know what you really want first
- Consider carefully how to record the data, e.g., via video

Data Gathering Techniques

Suppose you are developing a new software system to support a **small accountant's office**. There is a system running already with which the **users are reasonably happy**, but it is outdated and needs upgrading.

Based on the above descriptions, what kinds of data gathering techniques would be appropriate for establishing requirements of the new system? Why?

Data Gathering Techniques

- Small office implies a small number of stakeholders. Interviewing the staff rather than giving them questionnaires is likely to be appropriate because of the small number of users, and this will yield richer data and give the developers a chance to meet the users
 - Since the users are happy with the old system, observation is important to understand context of new and old system
 - Accountancy is regulated by a variety of laws and thus there is a need to look at documentation to understand some of the constraints from this direction
- > A series of interviews with the main users to understand the positive and negative features of the existing system; a short observation session to understand the context of the system; and a study of documentation surrounding the regulations

Data Interpretation and Analysis

- Good to start data interpretation just after data gathering activity, because experience will be fresh in the minds of the participants and this can help overcome any bias caused by recording via audio, video, etc.
- Initial interpretation before deeper analysis
- Interpretation: structure and record descriptions of requirements from collected data
- Analysis: obtain requirements from the interpreted data
- More interpretation and analysis \Rightarrow deeper understanding of requirements \Rightarrow requirements description will be expanded and clarified

Task Description

Description of user task can help users to articulate **existing work practices** and help to express envisioned use for **new products**

Three common description types are:

- **Scenarios**
 - an informal narrative story, simple, 'natural', personal, not generalisable
- **Use cases**
 - assume interaction with a system
 - assume detailed understanding of the interaction
- **Essential use cases**
 - abstract away from the details
 - does not have the same assumptions as use cases

Task Description

Example scenario for travel organizer:

“The Thomson family enjoy outdoor activity holidays and want to try their hand at sailing this year. There are four members of the family: Sky who is 10 years old, Eamonn who is 15 years old, Claire who is 35, and Will who is 40. While out on a shopping trip they call by at the travel agents in their local town to start exploring the possibilities ... The travel organizer is located in a quiet corner of the agents’ office, where there are comfortable seats and play things for young children. They all gather around the organizer and enter their initial set of requirements—a sailing holiday for four novices. The stand-alone console is designed so that all members of the family can interact easily and comfortably with it. The system’s initial suggestion is that they should consider a flotilla holiday, where several novice crews go sailing together and provide mutual support for first-time sailors...”

Task Description

Example use case for travel organizer:

1. The system displays options for investigating visa and vaccination requirements.
2. The user chooses the option to find out about visa requirements.
3. The system prompts user for the name of the destination country.
4. The user enters the country's name.
5. The system checks that the country is valid.
6. The system prompts the user for her nationality.
7. The user enters her nationality.
8. The system checks the visa requirements of the entered country for a passport holder of her nationality.
9. The system displays the visa requirements.
10. The system displays the option to print out the visa requirements.
11. The user chooses to print the requirements.

Task Description

Some alternative courses:

6. If the country name is invalid:

6.1 The system displays an error message.

6.2 The system returns to step 3.

8. If the nationality is invalid:

8.1 The system displays an error message.

8.2 The system returns to step 6.

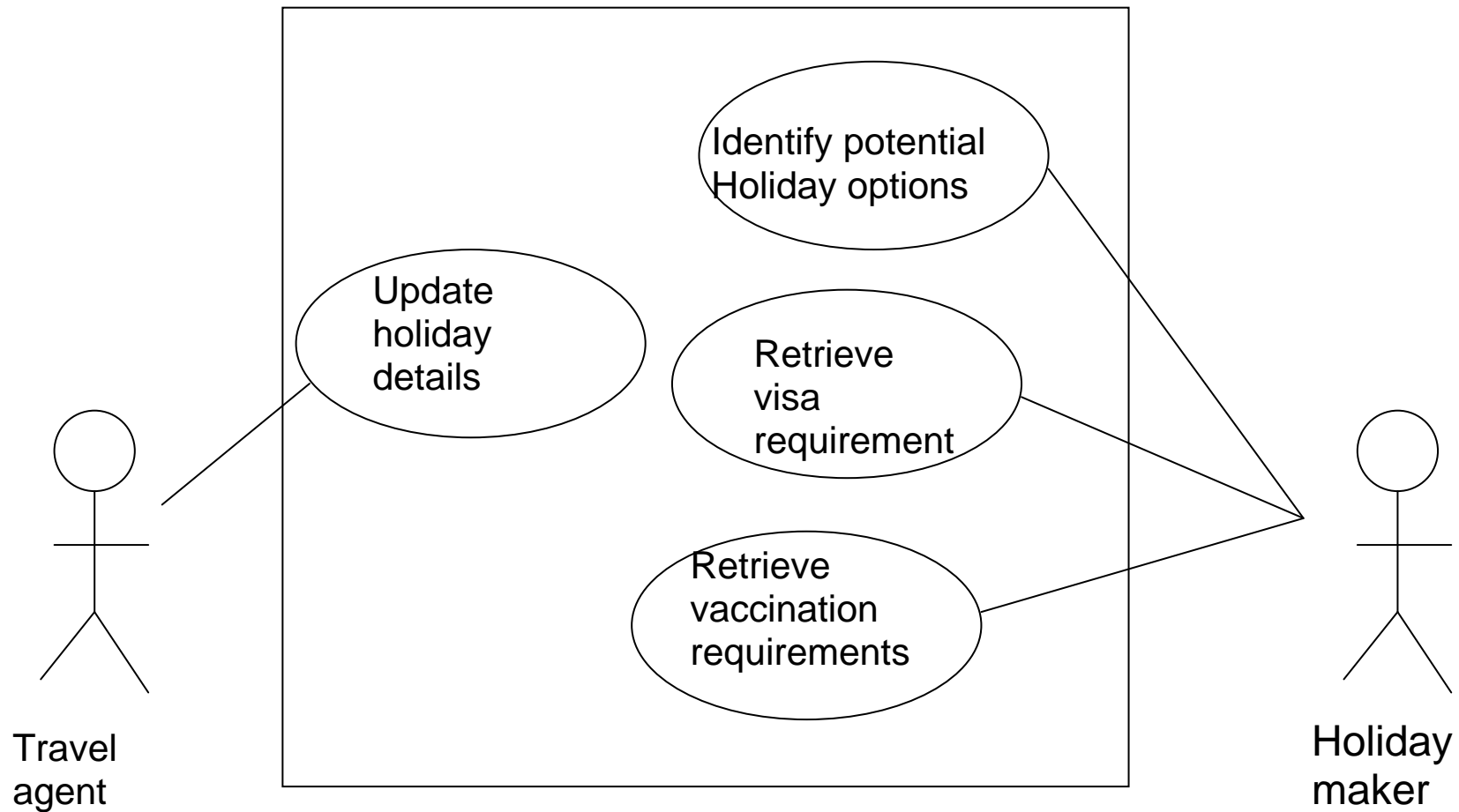
9. If no information about visa requirements is found:

9.1 The system displays a suitable message.

9.2 The system returns to step 1.

Task Description

Example use case diagram for travel organizer:



Task Description

Example essential use case for travel organizer:

retrieve Visa

USER INTENTION

SYSTEM RESPONSIBILITY

find visa requirements

request destination and nationality

supply required
information

obtain appropriate visa information

obtain copy of visa
information

offer information in different
formats

choose suitable format

give information in chosen format

Task Analysis

Analysing what users do by building a **complete description** of their duties

Used mainly to investigate an **existing situations** and **current practices**, not to envision new systems or devices, e.g., how a user does cooking with a microwave oven

The description of user tasks includes:

- **What** tasks they perform?
- **Why** they perform them?
- **How** they perform them?

Task Analysis

The three questions can be answered by obtaining

- **Goals:** What people want to accomplish
- **Tasks:** The mechanisms people use to accomplish goals
- **Actions:** Subcomponents of tasks

Example:

Goal: Get to mountain vacation



Tasks: Rent car, drive, get repairs



Action: Get gas



Hierarchical Task Analysis

- **Hierarchical task analysis** (HTA) is a very common technique for task analysis
- Involves breaking a **task down into subtasks**, then sub-sub-tasks and so on. These are grouped as **plans** which specify how the tasks might be performed in practice
- HTA focuses on physical and observable actions, and includes looking at actions not related to software or an interaction device
- Start with a user **goal** which is examined and the main tasks for achieving it are identified
- Use text and/or diagrams to show task-subtask **hierarchy** and plans to describe **order**

Hierarchical Task Analysis

Example: Determine the HTA for borrowing a book from the library

Task-subtask hierarchy:

0. In order to borrow a book from the library
 1. Go to the library
 2. Find the required book
 - 2.1 Access library catalogue
 - 2.2 Access the search screen
 - 2.3 Enter search criteria
 - 2.4 Identify required book
 - 2.5 Note location
 3. Go to shelf and get book
 4. Take book to checkout counter

Hierarchical Task Analysis

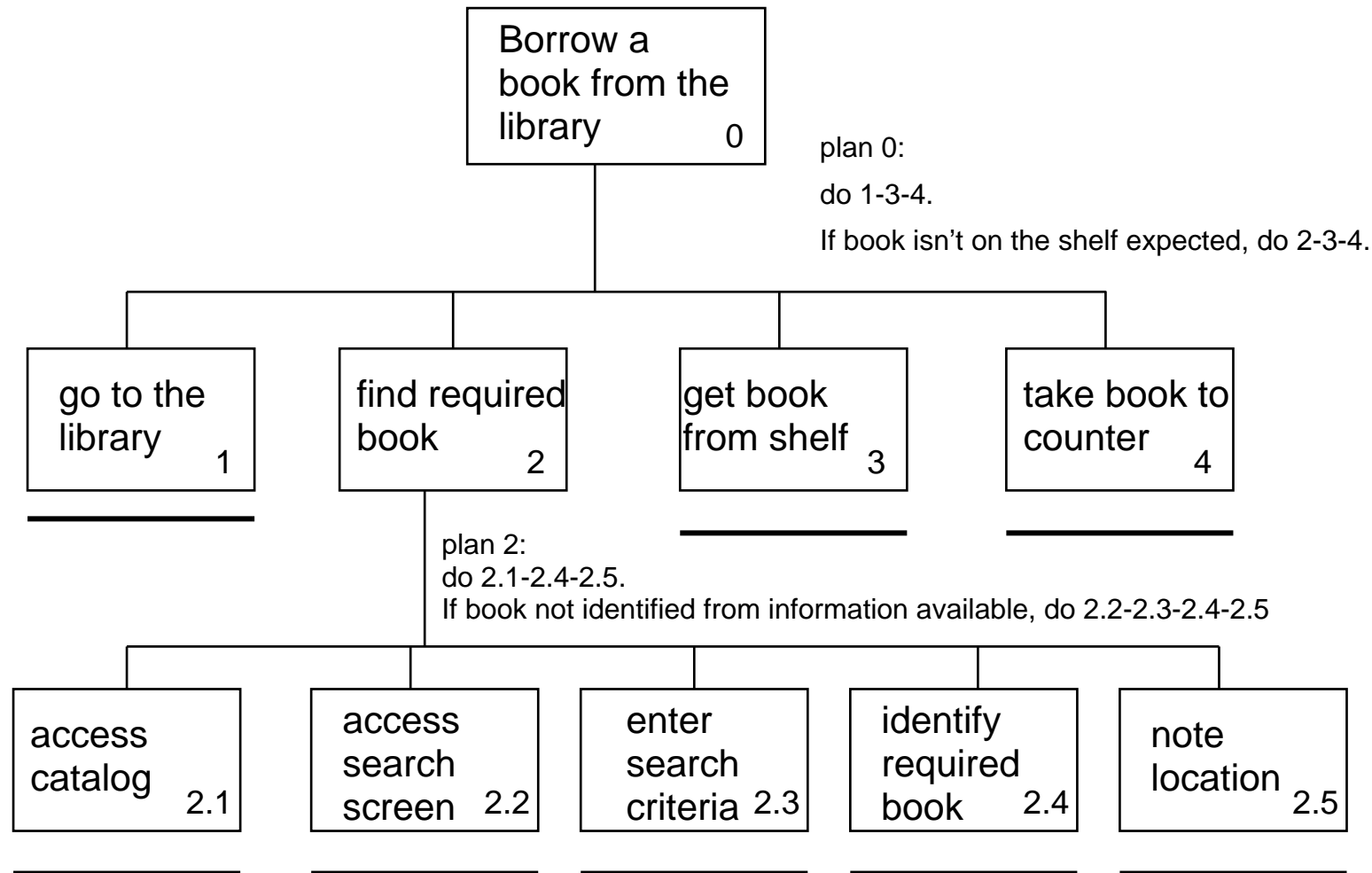
Plans to describe the task order:

- Plan 0: Do 1-3-4. If book is not on the expected shelf, 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.

This is called **textual** HTA

Hierarchical Task Analysis

Graphical HTA:



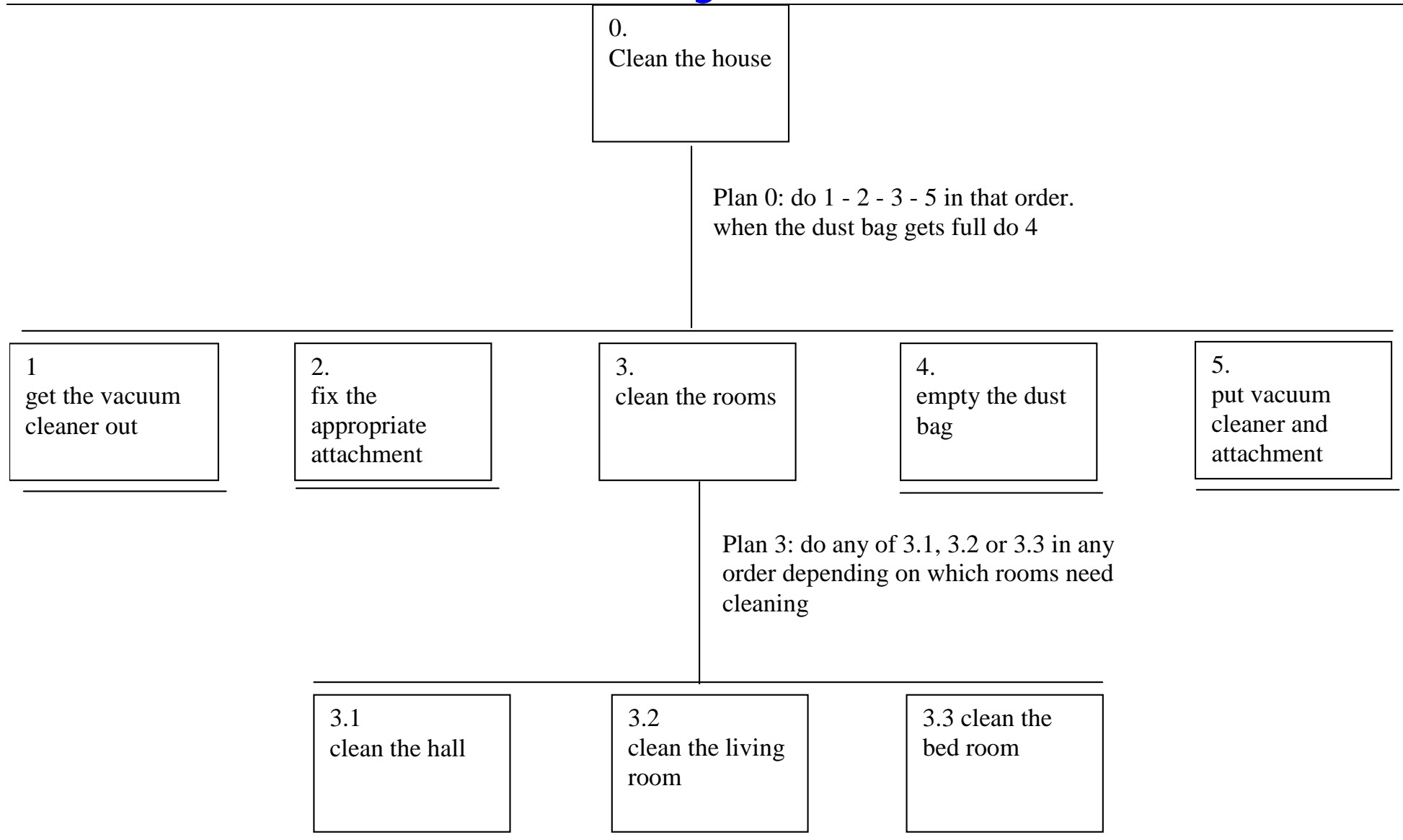
Hierarchical Task Analysis

Example: Determine the HTA for cleaning a house

- 0. In order to clean the house
 - 1. Get the vacuum cleaner out
 - 2. Fix the appropriate attachment
 - 3. Clean the rooms
 - 3.1 Clean the hall
 - 3.2 Clean the living room
 - 3.3 Clean the bedroom
 - 4. When the dust bag gets full, empty it
 - 5. Put the vacuum cleaner & attachments away

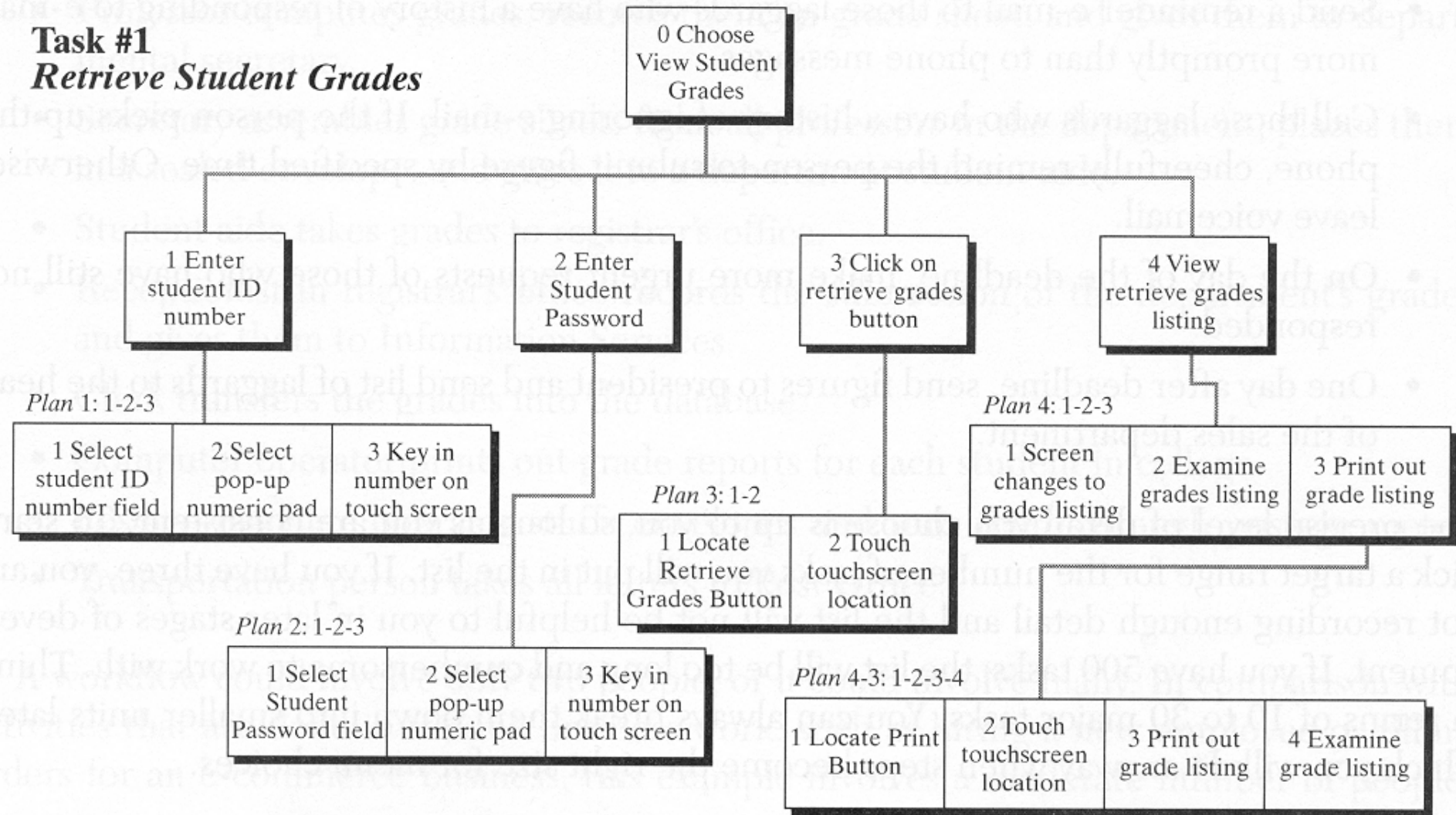
Plans: Plan 0: Do 1-2-3-5.
If the dust bag gets full, do 4
Plan 3: Do any of 3.1, 3.2 or 3.3 in any order
depending on which rooms need cleaning

Hierarchical Task Analysis



Hierarchical Task Analysis

Task #1 *Retrieve Student Grades*



Hierarchical Task Analysis

