Investigation: Understanding Problems and Solutions

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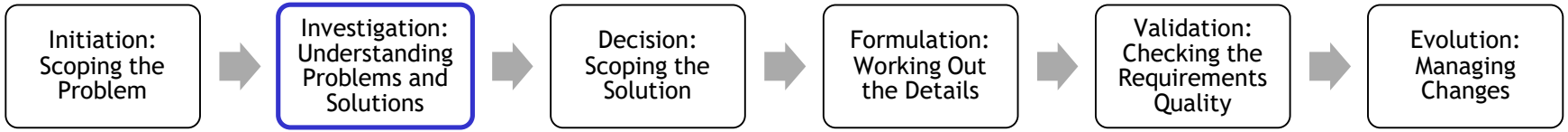
Phase 2: Investigation (a.k.a. requirements elicitation)



Objectives:

- understand the current situation (the World as-is)
- identify ideas and aspirations for the future situation (the World to-be)

Techniques:

- Background reading and data collection
- Interviews, workshops, surveys, observations
- Modelling the World as-is and to-be: domain scenarios, context diagram, process models, conceptual model

How to fail at discovering requirements

Ask the client the following questions

- What do you want?
- What are are your requirements?
- What do you want the software to do?
- What are your goals?

Requirements elicitation is an exploration and discovery process, not an inquisition.

Types of Stakeholders' needs

- Explicit needs
  - needs that stakeholders state explicitly; they are often symptomatic of some problematic situations to be fixed.
- Hidden needs
  - needs that stakeholders fail to mention because they know so much about them, and assume everyone has the same knowledge.
- Undreamed-of needs
  - things that are useful, but the stakeholders don't realize are possible.

Conditions for effective elicitation

- Involving the right stakeholders
  - to be identified during project initiation
  - to be revised throughout the project
- Stakeholders' commitment
  - major factor in project success or failure
  - part of the job involves getting stakeholders involved
- Analyst skills
  - interpersonal skills: be accepted by stakeholders and appear as partner
  - listening and observation skills
  - abstraction skills: be able to identify important information among mass of details and irrelevant points
  - reformulation skills: be able to reformulate acquired knowledge in a structured way

Outline

Difficulties of requirements investigation

Investigation techniques

Difficulties of Requirements Investigation

#1: Access to information

- Key people may be too busy and/or not interested.
- Documents and data may be difficult to collect.
- You need to consult a large number of stakeholders and documents.

E.g. A system using machine learning to support loan approval process

- *Key stakeholders are extremely busy; key meetings are cancelled and rescheduled several times.*
- *Loan approval is enacted and overseen by large number of stakeholders in the bank; all have different partial views on the whole process.*
- *Written rules and procedures exist but are hard to obtain; you need many emails and phone calls to obtain the information you need.*
- *The written rules and procedures are incomplete and spread over multiple documents.*

#2: Conflicting information

- Documents are not up-to-date, are inconsistent one with another, and use different terminology.
- Stakeholders have different background, culture and terminology.
- Inconsistencies between what you read, hear, and see.

E.g: ML system to support loan approval

- *The bank has many departments and branches. It's not clear if they all follow the same process and need the same support.*
- *The process you observe is different from how it is described.*
- *Different bank employees have different ideas of what support they need and what the ML system should do.*
- *Bank employees in different departments disagree on the meaning of technical terms in banking; data scientists use yet other technical terms for related concepts.*

#3: Tacit and hidden knowledge

- Tacit knowledge: knowledge that is hard to communicate orally or in writing (e.g. how your tie your shoes).
- Hidden knowledge: things that stakeholders fail to mention, either because they are not consciously aware of them, or because they believe it is so obvious that you already know it.

Example: eliciting rules and procedures for loan approval

- *Tacit knowledge: loan approval officers have difficulty explaining some of the steps and criteria used for approving a loan request.*
- *Hidden knowledge: loan approval should not discriminate on race or gender. (This need was mostly hidden until revelations of unintentional systematic discriminations in algorithms).*

#4: Power and Politics

- People want the project to server their own interests.
- There may be tensions between different groups.
- Some stakeholders are left out or insufficiently involved.
- People may distrust management and the project's motivation.
- People may be hostile to change, often due to bad past experiences.
- People may be afraid to give you information that may upset their boss.

E.g. ML system to support loan approval

- *The loan approval officers fear that your job is to computerize their jobs out of existence, so they deliberately emphasize the need for case-by-case discretion.*
- *You only hear about the needs of people who support the project, not those who are neutral or reticent.*

#5: Dealing with Changes

- Stakeholders' needs and priorities change over time.
- Context may change: regulations, technologies, partners, competitors.
- Organisational structure may change.
- Key people may leave organisation; others may be hired or given new role.

E.g: ML system to support loan approval

- *A few months into the project, the bank merges with another and you need to work with a new project manager with different ideas and priorities*
- *Regulation change requires stricter control*

Investigation Techniques

Common Investigation Techniques

1. Background reading
2. Data collection
3. Interviews
4. Workshops
5. Observations
6. Surveys and questionnaires
7. Prototyping
8. Analyzing Users Feedback

#1. Background study

What

Read reports, papers, and documentation about existing and related systems.

Why

To gain information about

- organization structure and goals
  - organizational charts, business plan, financial reports, policy manuals, job descriptions, etc.
- application domain
  - encyclopaedia entries, state-of –the-art surveys, published research papers, books, regulations, etc.
- current system
  - description of work procedures, business rules, organizational units, etc.
  - reports about defects, complaints, change requests, etc.

Background study: benefits and difficulties

- Benefits
  - Helps to prepare prior to meeting stakeholders
  - Provides basic information about
    - organization structure & objectives
    - application domain terminology
  - Will save time during interviews and workshops
- Difficulties
  - Potentially vast amount of documents to be considered
    - importance of abstraction skills: identifying what you need to know and what you don't need to know
  - written documents often do not match up to reality (inaccurate, incomplete, outdated)

Data Collection

- **Sources of Information**
  - work artefacts for current system: invoices, completed forms, mails, phone call recordings, …
  - management data: usage statistics, performance figures, costs data, …
- **Benefits:**
  - Useful for identifying relevant entities, attributes, and relationships
  - Useful source of quality requirements (e.g. related to usability, performance, cost, …) and level of quality achieved by current system
- **Difficulties:**
  - Data may be hard to interpret correctly
  - Difficulty of obtaining *representative samples*

#2. Interviews

Two meaning of interviews

1. In requirements engineering, an interview is a discussion with one stakeholder (or very small number of stakeholders) to elicit, clarify, or validate information about needs, context and requirements.
2. In social sciences, interviews are one of the data collection methods for qualitative research studies. The resulting interviews data are interpreted and analyzed through a systematic process.

Both can be used in the requirements engineering process.

Requirements interviews are cheapest and common.

Qualitative research interviews are important when you need a rich and nuanced understanding of the variety of people's lived experiences, beliefs, hopes, fears and values.

Guidelines for Requirements Interviews

1. Prepare
   - Select interviewees based on information to be acquired.
   - Prepare questions.
   - Send a brief agenda with topics to be covered and duration.
2. Conduct the interview
   - Explain context and purpose of interview
   - Take notes and draw models; interviewee often contribute to modelling (e.g. domain story)
   - Ask follow-up questions; ask for clarifications when you don’t understand.
   - Reformulate and summarize; check understanding and quality unknowns
3. Follow-up
   - Send “thank you” email that summarizes the interview and ask for validation, correction and refinements.

Interviews: benefits and difficulties

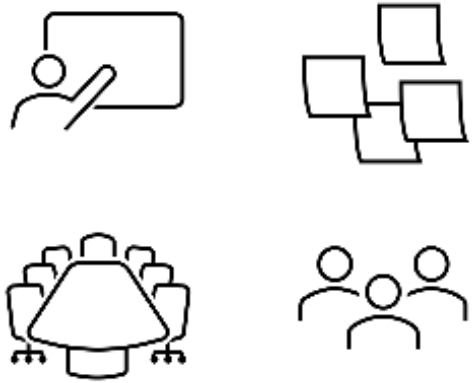
- Advantages
  - gives you information you can't find in documents.
  - can probe in depth and adapt follow-up questions.
  - good for uncovering opinions, feelings, goals, as well as hard facts.
- Difficulties
  - Stakeholders may have limited availability.
  - Tacit knowledge.
  - One interviewee often has a limited view of the whole process.
  - Conflicting information from different interviewees.

#3. Workshops

A *requirements workshop* is a structured meeting in which selected stakeholders and a workshop facilitator work together to create and refine specific deliverables in the requirements engineering process.

Not a generic meeting

- focus is on co-creation of deliverables rather than information exchange.
- follows a structured, facilitated process rather than a meeting agenda.
- more active, engaging and playful than a formal meeting.



Typically, 7 to 12 participants

Workshop Examples

Purpose	Workshop type	Deliverables
Defining the project scope	Scoping workshop	Project goals, scope and stakeholders
Understanding work processes	Domain story mapping	Collection of domain stories
	User story mapping	A user story map
	Storyboarding	Story boards
Identifying goals and features	Goal modelling	Goal – feature maps
	Impact mapping	Impact map (goal, actors, impacts, deliverables)
Understanding stakeholders	Stakeholders mapping	Stakeholder needs, relationships and influences on the project
	Empathy mapping	Empathy Maps (what stakeholders do, say, think, and feel).

Workshops: benefits and limitations

- Benefits
  - Facilitates rapid collection of information from multiple perspectives.
  - Allows discussing the work end-to-end, rather than by pieces in interviews.
  - Reveal conflicts that can be hard to surface in individual interviews.
  - Promotes mutual understanding and sense of ownership among stakeholders.
- Difficulties
  - Requires preparations and a skilled facilitator
  - Need to include the right stakeholders
  - Risk associated to group dynamics (e.g. a dominating individual)

#4. Prototyping

- Throwaway (mock-up) vs. evolutionary prototype
- Software prototype vs. “paper-based” prototype
- **Benefits**
  - excellent for eliciting tacit knowledge and hidden needs
  - good for engaging stakeholders on concrete proposals
- **Difficulties**
  - Important non-functional properties are ignored: performance, reliability, interoperability, etc.
  - Can be misleading and set stakeholders expectations too high

#5. Observation

What

- observer spends time with the subjects
- passive or active observation

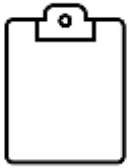
Benefits

- can reveal important tacit knowledge
- allows analyst to gain a more intimate understanding of the situation

Difficulties

- it may be hard to spot critical info in the mass of details
- probe effect: people behave differently when observed
- observer bias: observation and reporting can be tainted by observer's preconceptions

#6. Surveys & Questionnaires



Benefits

- Can quickly collect info from large numbers of people
- Can be administered remotely (e.g. email, online survey)
- Can collect attitudes, beliefs, characteristics

Difficulties

- Making people respond
- Simplistic, multiple choice questions provide little context
  - high risk of ambiguity
  - No room for users to convey their real needs

Watch for

- Bias in sample selection, bias in self-selecting respondents
- Small sample size, not representative
- Ambiguous questions (not everyone is answering the same question)

#7. Analysing User Feedback

What

Analyse feedback collected from multiple channels:

- app store reviews, forums, social media, emails
- suggestion boxes, suggestion wallpaper

Benefits

- low data collection cost
- encourage spontaneous participation
- can be flexible and easy to use

Difficulties

- extracting relevant information in mass of details
- conflicting information
- participation bias

Summary

The objectives of the investigation phase are to understand the world-as-is, and ideas and aspirations for the world-to-be.

- An exploration and discover process, not an inquisition.

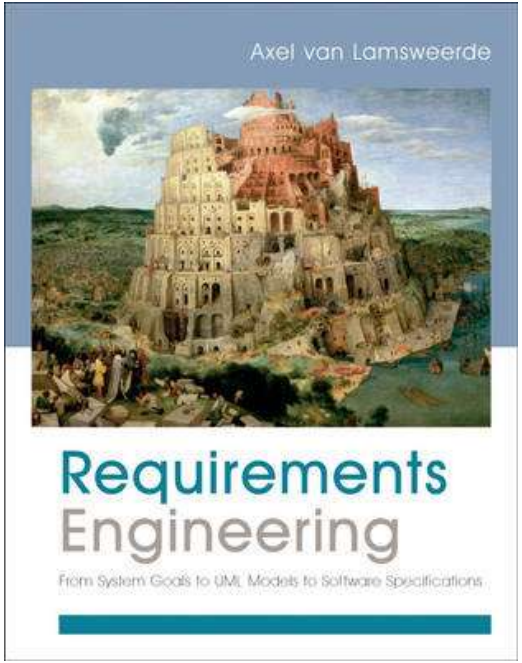
Difficulties

1. Access to information
2. Conflicting information
3. Tacit and hidden knowledge
4. Dealing with changes
5. Power and Politics

A toolbox of investigation techniques

1. Background reading
2. Data collection
3. Interviews
4. Workshops
5. Prototyping
6. Observations
7. Surveys and questionnaires
8. Analyzing Users Feedback

Reference and further reading



Chapter 2. Domain Understanding and Requirements Elicitation

Chapter 5. Investigating the Work