

Requirement Engineering

Lecture 3: Requirements Elicitation

Part 1

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Lecture Schedule Update

- 26.10.2022 → No lecture
- 02.11.2022 → Organization (L00) + Introduction (L01)
- 09.11.2022 → System Context Boundaries and Types of Requirements (L02)
- 16.11.2022 → Elicitation – Part 1 (L03)
- 23.11.2022 → Elicitation – Part 2 (L04) and Negotiations (L05)
- 30.11.2022 → Documentation – Introduction (L06)
- 07.12.2022 → Documentation – Textual Requirements Specification (L07)
- 14.12.2022 → Documentation – Model-based Requirements Documentation (L08)
- 21.12.2022 → No Lecture
- 11.01.2023 → Documentation – Formal Requirements Specification (L09)
- 18.01.2023 → Validation (L10)
- 25.01.2023 → Traceability (L11)
- 01.02.2023 → Requirements Management (L12) and Tool Support (L13)
- 08.02.2023 → Exam Q&A

Exercise Schedule Update

- 09.11.2022 → Exercise 01 – Knowledge Test (MC)
- 23.11.2022 → Exercise 02 – Elicitation I
- 30.11.2022 → Exercise 03 – Elicitation II
- 14.12.2022 → Exercise 04 – Agent-oriented Modelling
- 21.12.2022 → No Exercise
- 11.01.2023 → Exercise 05 – Coloured Petri Nets I
- 18.01.2023 → Exercise 06 – Coloured Petri Nets II
- 25.01.2023 → Bonus Task
- 01.02.2023 → Exercise 07 – Management and Traceability (MC)

General Requirements Engineering Process Overview

	Requirements Engineering				
	Requirements Analysis			Requirements Management	
	Elicitation	Negotiation	Documentation	Validation	Change Management

Lecture 3: Requirements Elicitation

Content

1. Getting the Right Information is Tricky
2. Requirement Sources
3. Elicitation Techniques



GETTING THE RIGHT INFORMATION IS TRICKY

Getting the Right Information is Tricky

Requirements Engineering = Communication

- In Software Engineering (SE) we can assume that there exists prior documentation → ***But not in Requirements Engineering***

Getting the Right Information is Tricky

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- In the beginning requirements are
 - unknown
 - unconscious
 - Misunderstood
- Furthermore there are different opinions about the requirements (in general at least one per stakeholder)

Getting the Right Information is Tricky

Requirements Engineering = Communication

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- In the beginning requirements are
 - unknown
 - unconscious
 - Misunderstood
- Furthermore there are different opinions about the requirements (in general at least one per stakeholder)
 - Acquisition of information as part of the requirements engineering activity is called **Elicitation**

Getting the Right Information is Tricky

Objectives of the Elicitation Phase

Why do we need to elicit information?

- Knowledge acquisition (Elicitation, Acquisition)
 - About involved persons and objectives
 - Current state
 - Expectations
 - Domain

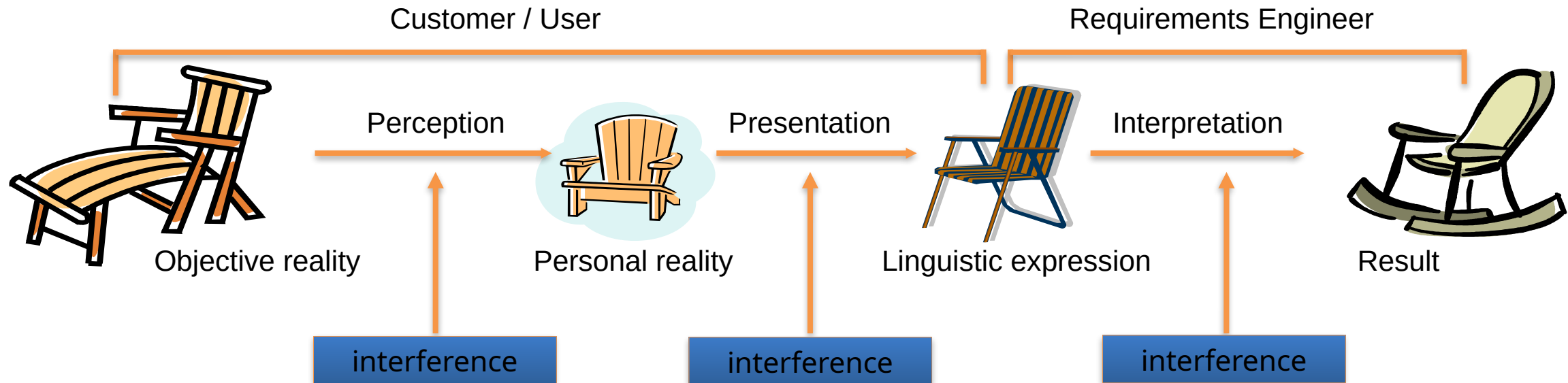
Requirements Engineering					
Requirements Analysis				Requirements Management	
Elicitation	Negotiation	Documentation	Validation	Change Management	Tracing

Getting the Right Information is Tricky

Communication Problems

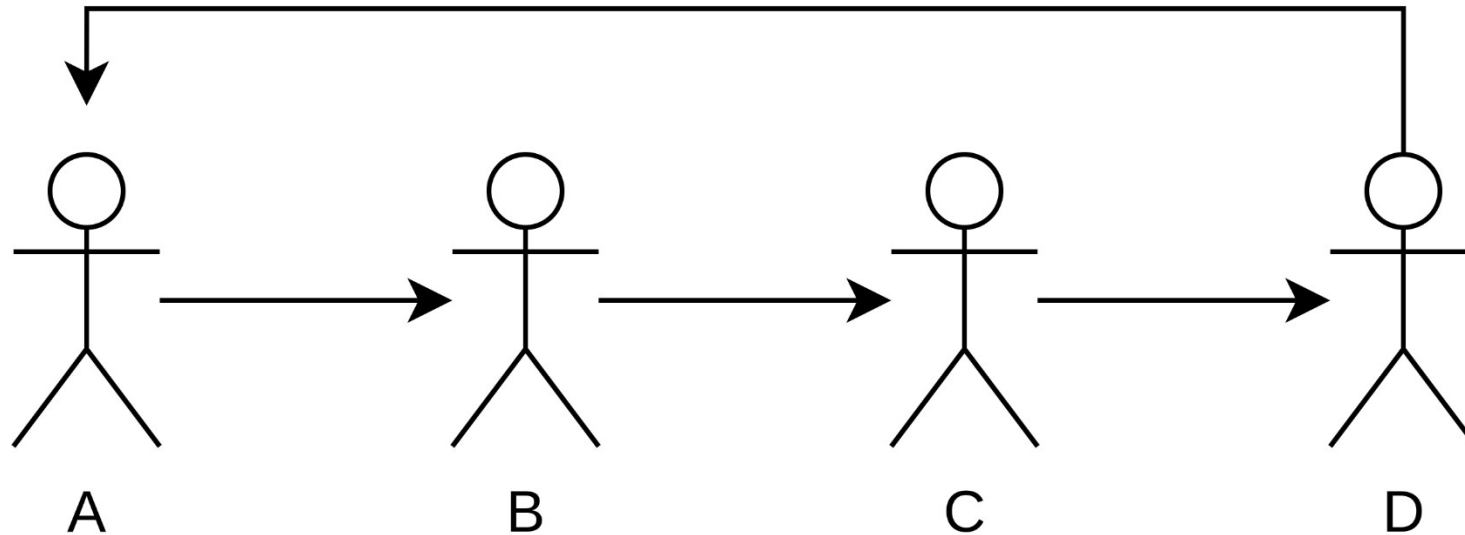
Communication happens via speech

- Representation of experiences → perceptions)
- Communication of personal reality → presentation) Conflicts



Getting the Right Information is Tricky

Communication Problems - Telephone Game



Youtube → [Link](#)

Getting the Right Information is Tricky

Communication Problems

- Consideration of all stakeholders
- Communication
 - Stakeholders can not describe abstractly what they are doing, why they are doing it, nor what they need to be able to do things.
 - Requests are much too general
- Presentation of new possibilities and their consequences
 - Stakeholder like to keep their existing approaches
 - It is difficult to invent new approaches

Getting the Right Information is Tricky

Communication Problems

- Conflicts
 - Cause of power struggles
 - Cause of opposition against changes
- Priorities
 - Stakeholders want too much
- Changes
 - Stakeholders always add new ideas



REQUIREMENT SOURCES

Requirement Sources

Sources

Three kinds of requirement sources:

- Stakeholders
 - People or organizations that influence the requirements of a system → users, operators, architects, testers, ...
- Documents
 - Contain important information that can provide requirements → e.g., standards, legal documents, requirements documents, error reports of legacy systems, ...
- Systems in operation
 - Legacy/predecessor systems or computer systems

Requirement Sources

Type of Knowledge to Gain

- Previous functions
 - e.g. secretary organized meetings
- Problems
 - e.g. status of the organization is not recognizable for everyone, takes too long
- Objectives for new functions / systems
 - e.g. transparent organization, faster
- Factors of success
 - e.g. organizing a typical meeting within one day
- Basic system architecture (how much components, partitioning)
 - e.g. install software for every employee

Requirement Sources

Type of Knowledge to Gain

- Realistic Solutions
 - e.g. System is gathering data, people are solving problems
- Consequences and risks
 - e.g. too little freedom of decision for participants

Requirement Sources

Typical Stakeholders

- Customer
 - Actual and potential customers
 - Project leader
 - Business manager
- User
 - Old and new users

Requirement Sources

Typical Stakeholders

- Developer
 - Product marketing
 - Project leader
 - Technical leader
 - Architect / Designer
 - Developer
 - Tester
 - Legal Department

- Maybe in different locations, maybe in competing divisions

Requirement Sources

Significance of Stakeholders

- Stakeholders are the main source of requirements
- Missing stakeholders → Missing requirements
 - Leads to change requests
 - Retroactive changes are expensive
- Not all stakeholders are equally important
 - The stakeholders also require prioritization → **Never tell them!**
 - Maintain checklists of all stakeholders

Requirement Sources

Maintenance of Stakeholder Data

- Use tables and spreadsheets to handle stakeholder data
- For each stakeholder, maintain at least:
 - The name
 - The function
 - Additional personal and contact data
 - Temporal and spatial availability during the project progress
 - Relevance of the stakeholder
 - Area and extent of expertise of the stakeholder
 - Goals in interests regarding the project

Requirement Sources

Handling Stakeholders Throughout the Project

- Continuous exchange of information
 - Periodic status updates
 - Continuous involvement turns stakeholders from affected by the project into collaborators
 - Principally affected stakeholders vs. well-integrated, jointly responsible stakeholders
- Lack of attention may lead to overcritical stakeholders
 - However, stakeholders might not be motivated from the beginning → e.g., they like the existing legacy system
- Requirements engineer supports project management with convincing stakeholders of the benefit of a project

Requirement Sources

Agreement with Stakeholders

- Formal agreements with stakeholders are often useful
 - Avoid misunderstandings and disputes regarding competence
- Such agreements should include
 - Tasks
 - Responsibilities
 - Managerial authority
 - Individual goals
 - Communication paths
 - Feedback loops

Requirement Sources

Agreement with Stakeholders

- Can be informal (“shaking hands”) or formal with written documents
 - Should be signed of by the management

Requirement Sources

Tasks of the Requirements Engineer

- Speaks language of the stakeholders
- Becomes thoroughly familiar with the application domain
- Creates a requirements document
- Is able to get work results across
- Maintains a respectful relationship with any stakeholder
- Presents ideas and alternatives as well as realizations
- Allows stakeholders to demand properties that make the system user-friendly and simple.
- Ensures that the system satisfies the functional and qualitative demands of the stakeholders

Requirement Sources

Tasks of the Stakeholder

- Introduce the requirements engineer into the application domain
- Supply the requirements engineer with requirements
- Documents requirements assiduously
- Make timely decisions
- Respect the requirements engineer's estimates of costs and feasibility
- Prioritize requirements

Requirement Sources

Tasks of the Stakeholder

- Inspect requirements that the requirements engineer documents, such as prototypes, etc.
- Communicate changes in the requirements immediately
- Adhere to the predetermined change process
- Respect the requirements engineering process that has been instated

ELICITATION TECHNIQUES

Elicitation Techniques

Overview

- Support the identification of the conscious, unconscious, and subconscious requirements
 - No universal method!
 - Elicitation techniques must match the project
- Factors for choosing a technique are
 - The distinction between conscious, unconscious and subconscious requirements
 - Time and budget constraints
 - Availability of stakeholders
 - Experience with a particular technique
 - Chances and risks of the project
- Combination of different techniques minimizes risks

Elicitation Techniques

Overview

Survey Techniques	Creativity Techniques	Document-centric Techniques	Observation Techniques	Support Techniques
Interviews	Brainstorming	System Archaeology	Field Observation	Mind Mapping
Questionnaires	Brainstorming Paradox	Perspective-based Reading	Apprenticing	Workshops
	Change of Perspective	Reuse		CRC Cards
	Analogy Technique			Audio and Video Recording
				Use Case Modeling
				Prototypes

Elicitation Techniques

Aquisition Techniques



p = possible
g = good
v = very good

Things to elicit Techniques	Present work Present problems Critical issues/goals	Future system ideas Realistic possibilities Consequences & Risks	Commitment Conflict resolution	Requirements Priorities Completeness
Stakeholder analysis	g v	p p	g g	p
(Group) interview	v v g	p		p
Observation	v g			p g
Task demo	v v g			p g
Document studies	v g			p g
Questionnaires	g g p			
Brainstorm		v		p
Focus groups	v v	v	g p	p v
UI Workshops	p	v g p	g p v	
Prototyping		p v g	g	v g
Pilot experiments	p	v v	v	g g g
Similar companies	p g	v v v		g
Suppliers	p p	g v g		g
Negotiation	p g	p p p	v v	g v
Risk Analysis	g	g v		p
Cost/benefit	g v	p p v	p	v
Goal-domain analysis	g v	g p v	g p	g g v
Domain-requirements	p g	p		v g g

Elicitation Techniques

The most common / important techniques

- Interview
 - More time consuming
 - Requires explicit integration of standpoints
 - Allows better adaptation on background of the interviewed person and interests of the interviewee

- Observations
 - Most complicated technique
 - Least impact of presumptions

Elicitation Techniques

The most common / important techniques

- Workshop
 - Frequently used technique
 - Relative little expenditure of time
 - Fundamental for team creation
 - Creates new ideas (→ Vision workshop)
 - Problems with social structures, focus on hot spots

- Other techniques may be used in addition

Elicitation Techniques

Survey Techniques

- The requirements engineer asks questions, the stakeholders answer
 - Driven by the requirements engineer
 - Possible that stakeholder concerns are missed
- Used for eliciting explicit knowledge
 - Conscious requirements
- Assumptions:
 - All respondents are capable of explicitly expressing their knowledge
 - All respondents are committed to invest time and effort

Elicitation Techniques

Survey Techniques - Interviews

- Can be employed during the entire development
- Requirements engineer prepares questions beforehand
 - Might be the same for multiple stakeholders
- Questions that arise during the interview can be discussed immediately
 - Clever questions may uncover subconscious requirements
- Experienced interviewers
 - control the course of the conversation
 - commit themselves to each stakeholder
 - inquire about specific aspects
- Drawback of interviews: very time-consuming

Elicitation Techniques

Survey Techniques - Interviews

- Preparation
 - Analysis of documents (e.g. scenarios, previous work documents)
 - Prepare questions (with at least one domain expert)
- Performance
 - Two interviewers if possible (Analyst; Transcript writer)
 - Single or multiple person interviews
 - Maybe recording on tape
- Analysis
 - Analysis / Summary of answers
 - Feedback to participants

Elicitation Techniques

Survey Techniques – Prepare an Interview

- Purpose → Define the purpose of the interview explicitly
- Participants (interviewees)
 - Invite participants, taking the object of the interview into account
 - Communicate with participants (invitation, purpose and background)
- Location → Select a suitable location for the interview
- Questions
 - Prepare open and closed questions, where possible with a specific context (with at least one domain expert)
 - Avoid leading questions
- Interviewer → Make yourself familiar with the participants and their terminology

Elicitation Techniques

Survey Techniques – Conduct an Interview

- Introduction
 - What is the interview good for?
 - What will happen with the answers?
- The questionnaire
 - Start general, progress to more specific issues
 - Mixture of open and closed questions
 - Active listening! (esp. paraphrasing)
 - Ensure non-verbal communication
 - Prevent typical mistakes:
 - Deviation from topic
 - Answers too general
 - Uneasy atmosphere (noise, interruptions, etc.)

Elicitation Techniques

Survey Techniques – Conduct an Interview

- Finish
 - Comment on the first impression
 - Outline further activities
 - Thank the interviewed person
 - Interviewed person has the final say

Elicitation Techniques

Survey Techniques – Post-processing the Interview

- Write a protocol of the interview
- Document explicitly gained requirements
- Revise your models and scenarios used for the interview
- Make a to-do-List of the remaining questions
- Further communication with the interviewed persons
 - Give them your results, so they can check and confirm them
 - Identify conflicts between the requirements
 - Try to resolve identified conflicts

Elicitation Techniques

Survey Techniques - Questionnaires

- Only viable option for a large number of participants
 - Cheap and time efficient in comparison to interviews
 - May use online questionnaire
- Can use different kinds of questions
 - Open questions → What do you think is the most important feature of the new system?
 - Closed questions → Do you think the new system requires a GUI?
 - Closed questions better suited for less experienced stakeholders

Elicitation Techniques

Survey Techniques - Questionnaires

- Drawbacks
 - Only for eliciting requirements known or conjectured → Not able to pose additional question due to feedback
 - No immediate feedback → Forgotten or badly phrased questions possible

Elicitation Techniques

Overview

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Elicitation Techniques

Creativity Techniques

- Well-suited for:
 - Outlining an initial vision of a system
 - Developing innovative requirements
 - Eliciting excitement factors
- Not well-suited for getting fine-grained requirements
 - Techniques yield general ideas about possible requirements, not specifics
 - Especially unsuited for complex charting of system behavior

Elicitation Techniques

Creativity Techniques – Brainstorming

- Fixed timeframe
- Usually in groups of 5 to 10 people
- Moderator documents ideas without discussing, judging, or commenting on them
 - Participants expand and modify ideas to add new ones
- Once the ideas are collected, they are discussed
 - Each idea is subjected to thorough analysis
- Especially effective if different stakeholders are involved

Elicitation Techniques

Creativity Techniques – Brainstorming

- Large number of ideas can be collected in a short amount of time
- People can expand on ideas collaboratively
- Unbiased collection allows new ideas and solutions to pop up
- Effectiveness depends on the group dynamics
 - Varied levels of dominance effectively reduce number of participants
 - Other techniques better suited → 6-3-5 method: six participants, three ideas each, fivefold hand-off

Elicitation Techniques

Creativity Techniques – Brainstorming Paradox

- Variant of brainstorming
- Collects events that must not occur, instead of ideas
- Develops measures to prevent the events
- Well-suited for the early identification of risks and countermeasures
- Same advantages and drawbacks as brainstorming

Elicitation Techniques

Creativity Techniques – Change of Perspective

- Involved people change their perspective
- Most popular: Six Thinking Hats → Approach a problem from six different perspectives
 - Information: what is available
 - Emotions: intuitive reactions
 - Discernment: logical analysis of reasons to be cautious

Elicitation Techniques

Creativity Techniques – Change of Perspective

- Optimistic response: logically identifying benefits
- Creativity: provocation and investigation
- Ordered: overview over processes, “big picture”
- → Solutions approach the problems from different standpoints
- Stakeholders convinced of their opinion are persuaded to adopt a different point of view



Elicitation Techniques

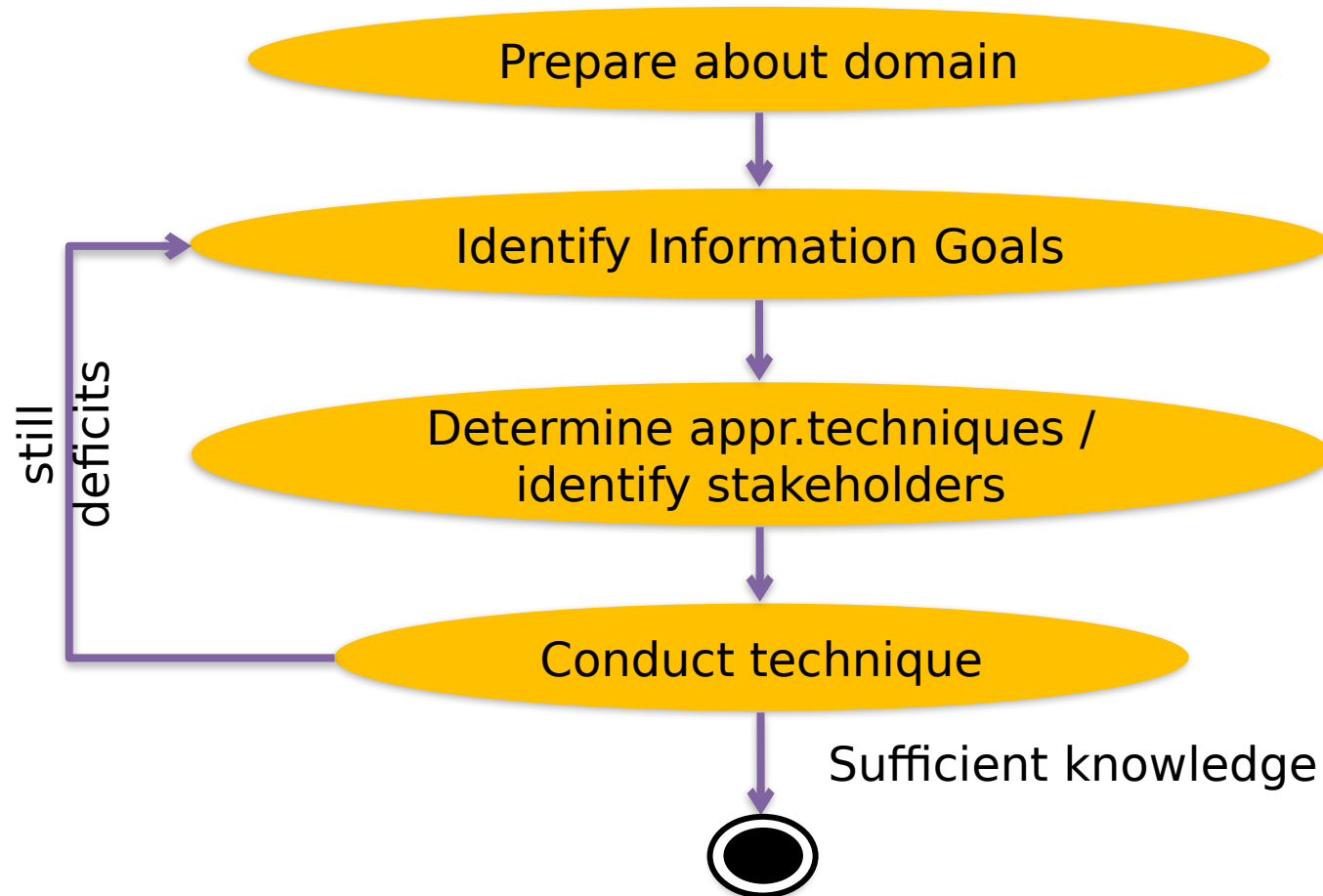
Creativity Techniques – Analogy Technique

- Provide an analogy for the system or a partial problem
 - Discuss the analogy instead of the system
 - Draw conclusions for the real system based on the analogy
- Assumes that each participant is capable of analogous thinking
- Can be applied in the open or covertly
 - Covert application
 - Only the requirements engineer knows the relationship to the real system
 - Participants only know the analogy
 - Requirements engineer responsible to map everything back to the real world
 - Open application → Everybody knows the relationship to the real system

SUMMARY

Summary

Planning Requirement Elicitation



Not shown:

- Application of analysis techniques
- Often overlapping and parallel activities

Summary

- Elicitation is a core activity of requirements engineering
 - Without good elicitation, requirements will be wrong or missing
- Stakeholders, documents and existing systems as requirements sources
 - Missing a source leads to missing the requirements of the source
- Many techniques for requirements elicitation
 - Not every technique is good in every scenario
 - Select the techniques depending on the project
 - Usually, a combination of multiple techniques yields the best results



Questions?