Requirement Engineering

Lecture 3: Requirements Elicitation

Part 1

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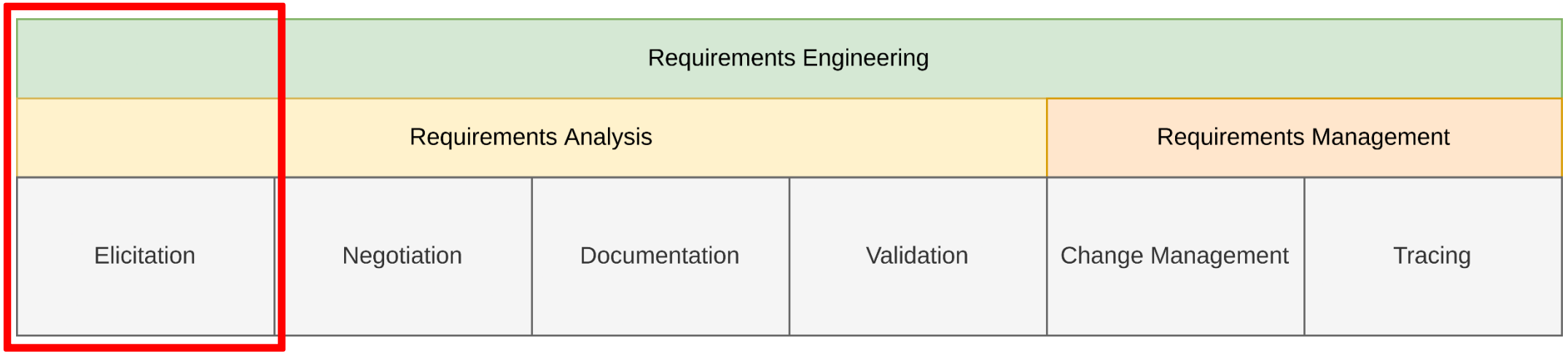
General Requirements Engineering Process

Overview



Lecture 3: Requirements Elicitation

Content

GETTING THE RIGHT INFORMATION IS TRICKY

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Requirements Engineering = Communication

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

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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

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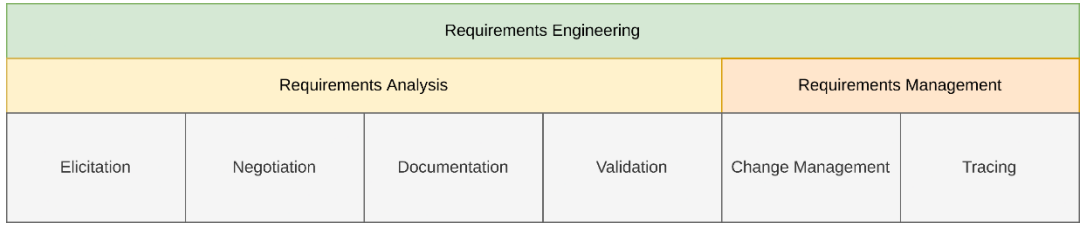
→ Acquisition of information as part of the requirements engineering activity is called **Elicitation**

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

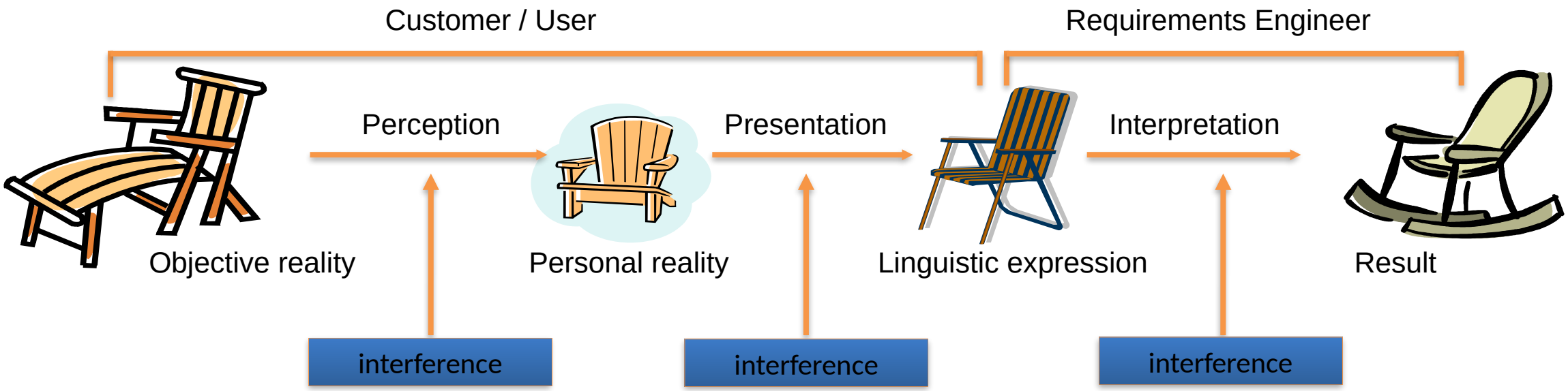


Getting the Right Information is Tricky

Communication Problems

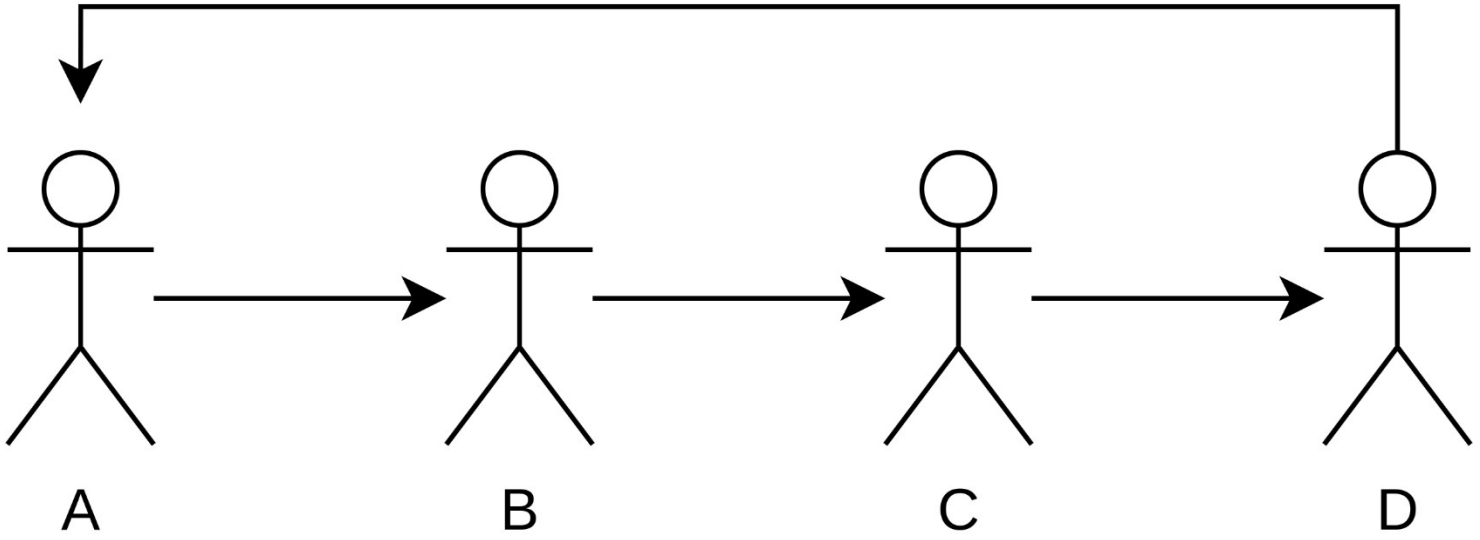
Communication happens via speech

- 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

Techniques \ Things to elicit	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

p = possible
g = good
v = very good

Based on S. Lauesen (2002) – Software Requirements – Styles and Techniques

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

A.M. Hickey, A.M. Davis (2003) – Elicitation Technique Selection: How do Experts do it?

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

A.M. Hickey, A.M. Davis (2003) – Elicitation Technique Selection: How do Experts do it?

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

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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

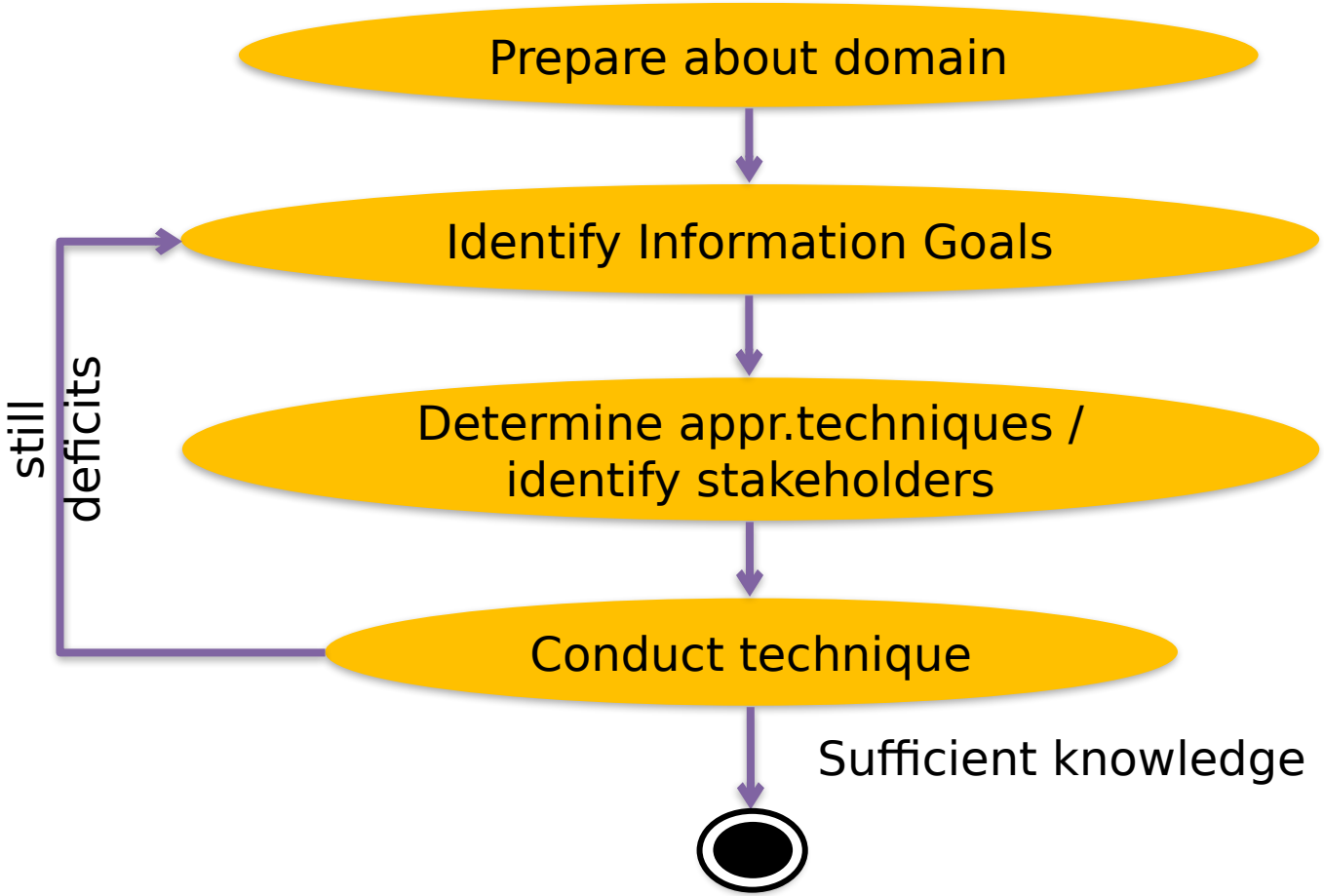
Creativity Techniques – Analogy Technique

- 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?