SE463
Software Requirements Specification & Analysis

Elicitation

The Problem Is To Know What the Problem Is

"The most difficult part of requirements gathering is not the act of recording what the user wants, it is the exploratory developmental activity of helping users figure out what they want."

Steve McConnell, *Software Project Survival Guide*, 1998

Requirements Engineering Process

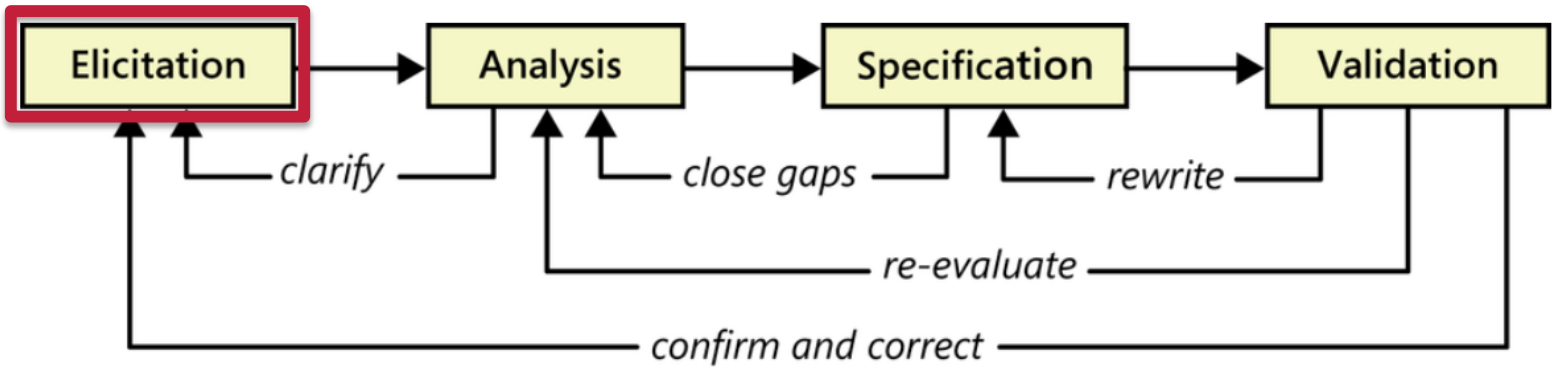


Figure 3-1. Requirements development is an iterative process.

Karl E Wiegers and Joy Beatty, *Software Requirements 3ed*, 2013

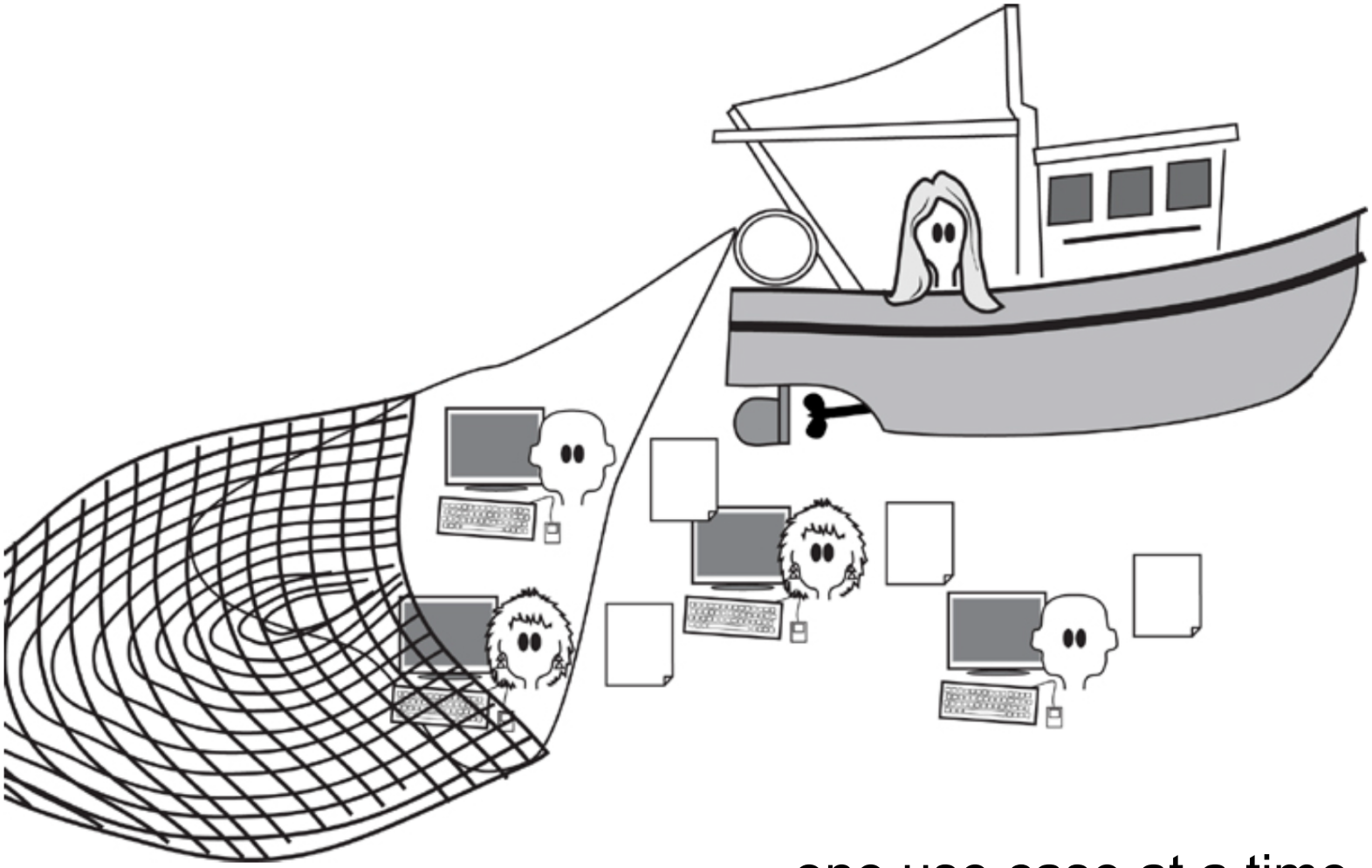
Elicitation

To elicit means “to bring out, to evoke, to call forth”

The purpose of elicitation is to learn the requirements of the system, by

- investigating the current work and current problems
- asking about requirements and goals
- understanding the environment in which the system will operate

“Trawling” for Requirements



…one use case at a time.

Information to Elicit

- Required functionality - what the software should do

  record keeping, data computations / transformations, process control, query processing, commands to hardware devices or adjacent systems

- Quality attributes - desired characteristics of the software

  performance, efficiency, safety, security, usability, maintainability, reliability, robustness, availability

- Design constraints - customer-specified limits on solution space

  mandated hardware components, mandated adjacent systems, resource constraints, mandated development process, time/budget constraints

- Environmental assumptions - assumed context of the software

  working status of hardware / software components, assumptions about inputs (data format, rate of input, number of users), operating conditions

- Preferences

  priority rankings of requirements

Elicitation and Documentation

requirements will be elicited/negotiated, but perhaps not documented; requirements of increments are sketched, with details kept in the heads of the (small group of) stakeholders

because of the number of stakeholders and the length of increments/projects, there is greater need for some documentation – to record information learned, and to communicate it to others

the large number of stakeholders, the length of the project and need to remember information over a long period, the criticality of getting the requirements right – all dictate a strong need for requirements documentation

Elicitation exercise

DayDreams is a company that helps people to actualize and experience their definition of a perfect day.

- Need volunteer customer

Elicitation techniques

- Document studies
- Similar companies
- Norms
- Domain analysis
- Requirements taxonomies
- Modelling
- Analysis patterns
- Mockups & prototyping
- Pilot experiments
- Stakeholder analysis
- Questionnaires
- Interviews
- Observation
- Task Demo
- Ask suppliers
- Domain workshop
- Personas
- Systemic Thinking
- Brainstorm
- Creativity workshop

Artifact-based elicitation

Idea: learn as much as we can by studying documentation, systems, artifacts, etc. before asking for stakeholders' time

- *Document studies*
- *Similar companies*
- *Norms*
- *Domain analysis*
- *Requirements taxonomies*

Artifact-based

- Modelling
- Analysis patterns
- Mockups & prototyping
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Documents

- System documentation

  e.g., existing requirements specifications, design documents, bug reports, change requests user manuals, work procedures, usage statistics, marketing data, performance figures

- Environment documentation

  e.g., organization charts, business plans, policy manuals, financial reports, minutes of important meetings

- Domain analysis

  e.g., textbooks, surveys, standards, regulations, the Web

Norms

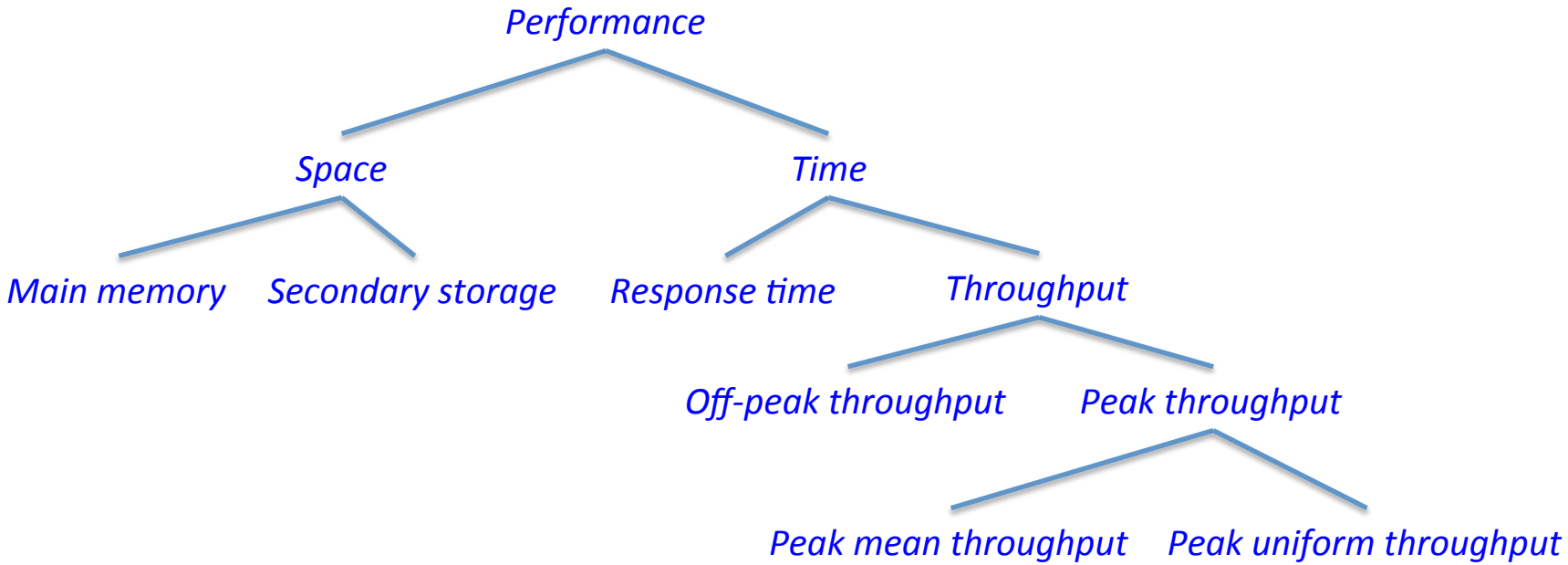
Build a better X.

Example: Build a better messaging app that runs on Linux and supports multiple messaging protocols and photos.

Requirements taxonomies

Requirements taxonomy — classification of requirements; the classification can act as a checklist of details to be elicited.

Example: Domain-*independent* taxonomy for performance-related NFRs



Example: Domain-*dependent* taxonomy for information systems:

PIECES ≡ Performance, Information and data, Economy, Control, Efficiency, and Services

Model-based elicitation

Idea: To re-express the requirements in a different language, which can raise new questions.

- Document studies
- Similar companies
- Norms
- Domain analysis
- Requirements taxonomies
- *Modelling* *Model-based*
- *Analysis patterns*
- *Mockups & prototyping*
- *Pilot experiments*
- Stakeholder analysis
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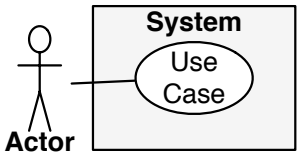
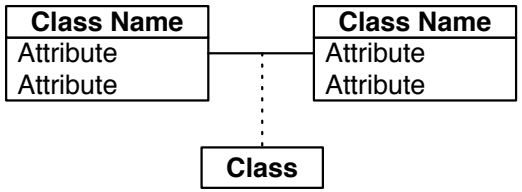
Models

The act of re-expressing the owner's work or requirements as models in different languages often reveals "holes" in our understanding

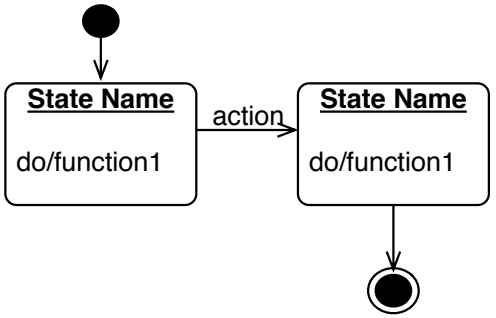
- Ideally, models are simple enough that stakeholders are encouraged to modify them
- Models are useful in requirements documentation





context Membership **inv**
self.transactions->collect(points)->sum = self.points

Display Available Numbers	ID: O12	Importance: D
Overview: Display all of the available phone numbers		
Inputs: requestor:Administrator		
Preconditions: requestor has authenticated, there is no data lock on phones (set of Phone)		
Modifies: *none*		
Postconditions: returns all num ∉ phones.phoneNumber; numbers are displayed in numerical order		
Exceptions: There is a data lock on phones, and error code "operation failed" is returned		
References: Meeting #3: R7		



Effective Models

Restrict the amount of detail we include in our models of the current system—there is no point modeling every tiny facet of something we are about to replace.

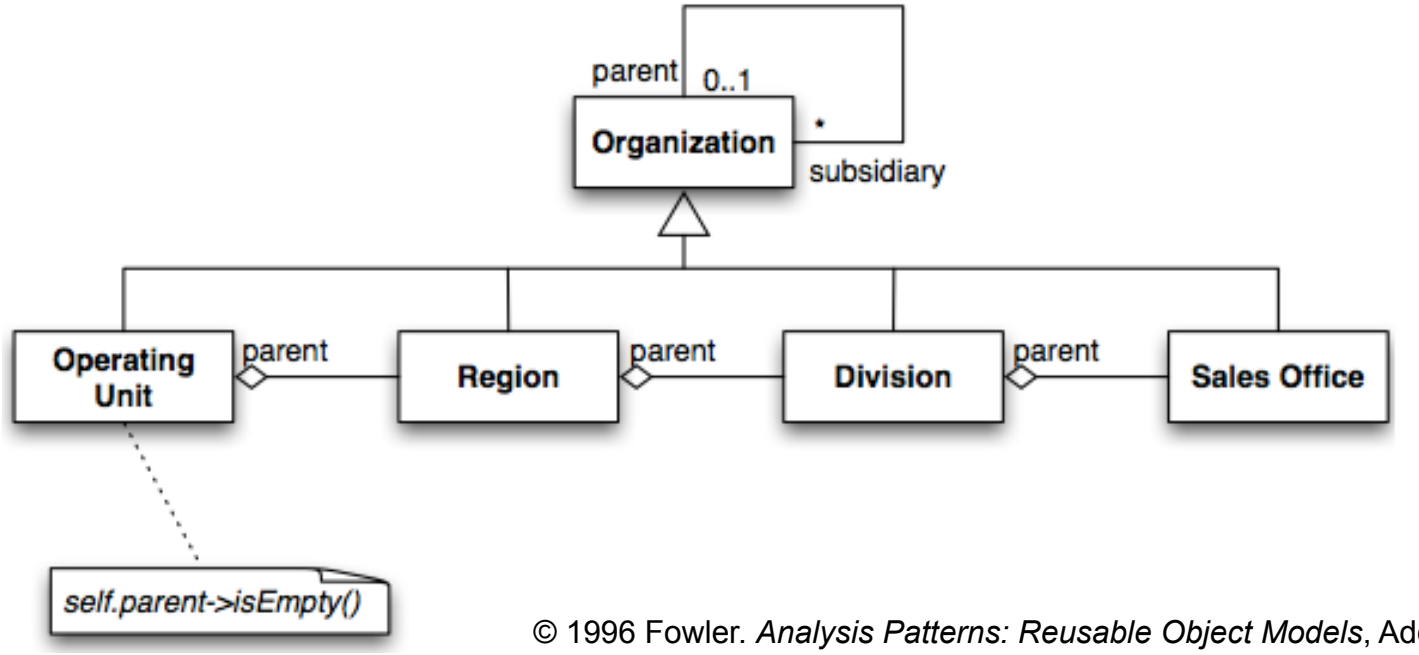
- scenarios
- activity diagrams
- process models
- business rules

Do not restrict the scope of the work being modelled – the more of the work we study, the more opportunities for improvement that will emerge.

Analysis patterns

Analogous to design patterns, which are templates for OO designs, there is work on analysis patterns, which are templates for modelling common business problems.

e.g., Pattern for organizational relationships

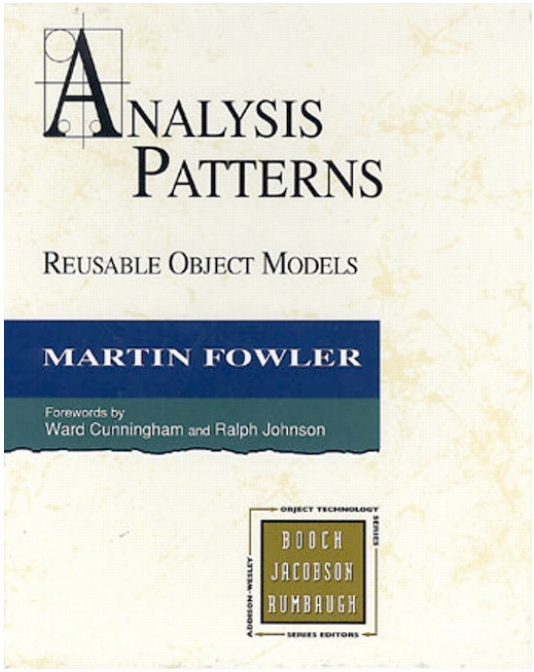


© 1996 Fowler. *Analysis Patterns: Reusable Object Models*, Addison-Wesley

Analysis patterns

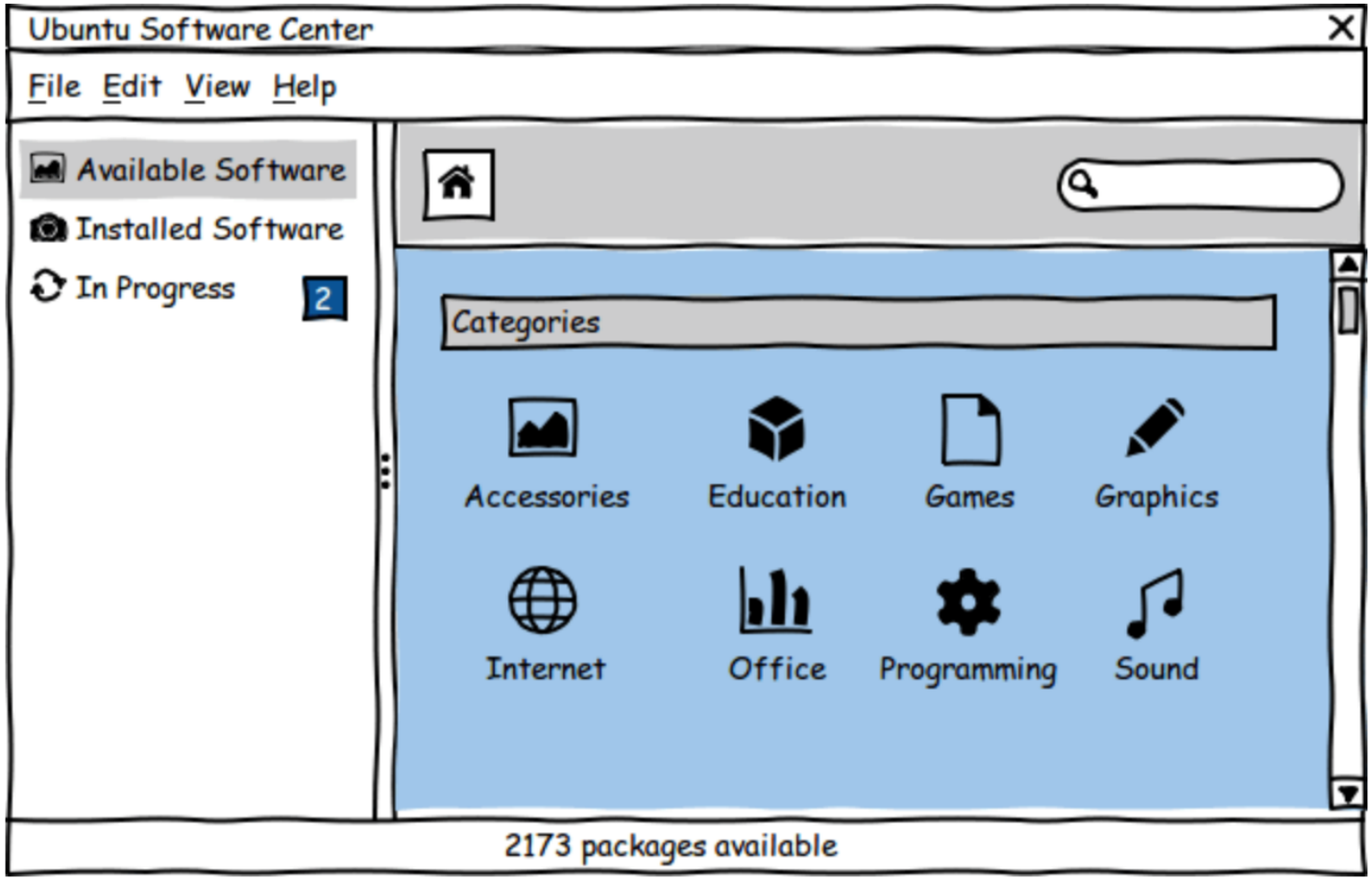
The best known collection of analysis patterns is Fowler's *Analysis Patterns: Reusable Object Models.*

- Organization patterns — about modelling accountability
- Observations and Measurements
- Accounting, Transactions
- Planning
- Trading — financial service systems



Mockups and Prototypes

Sketch the essence of a solution, and use to bait stakeholders into providing new requirements details



Stakeholder-based elicitation

Idea: Acquire detailed information about the system-to-be that is problem specific or stakeholder specific.

- Document studies
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- Analysis patterns
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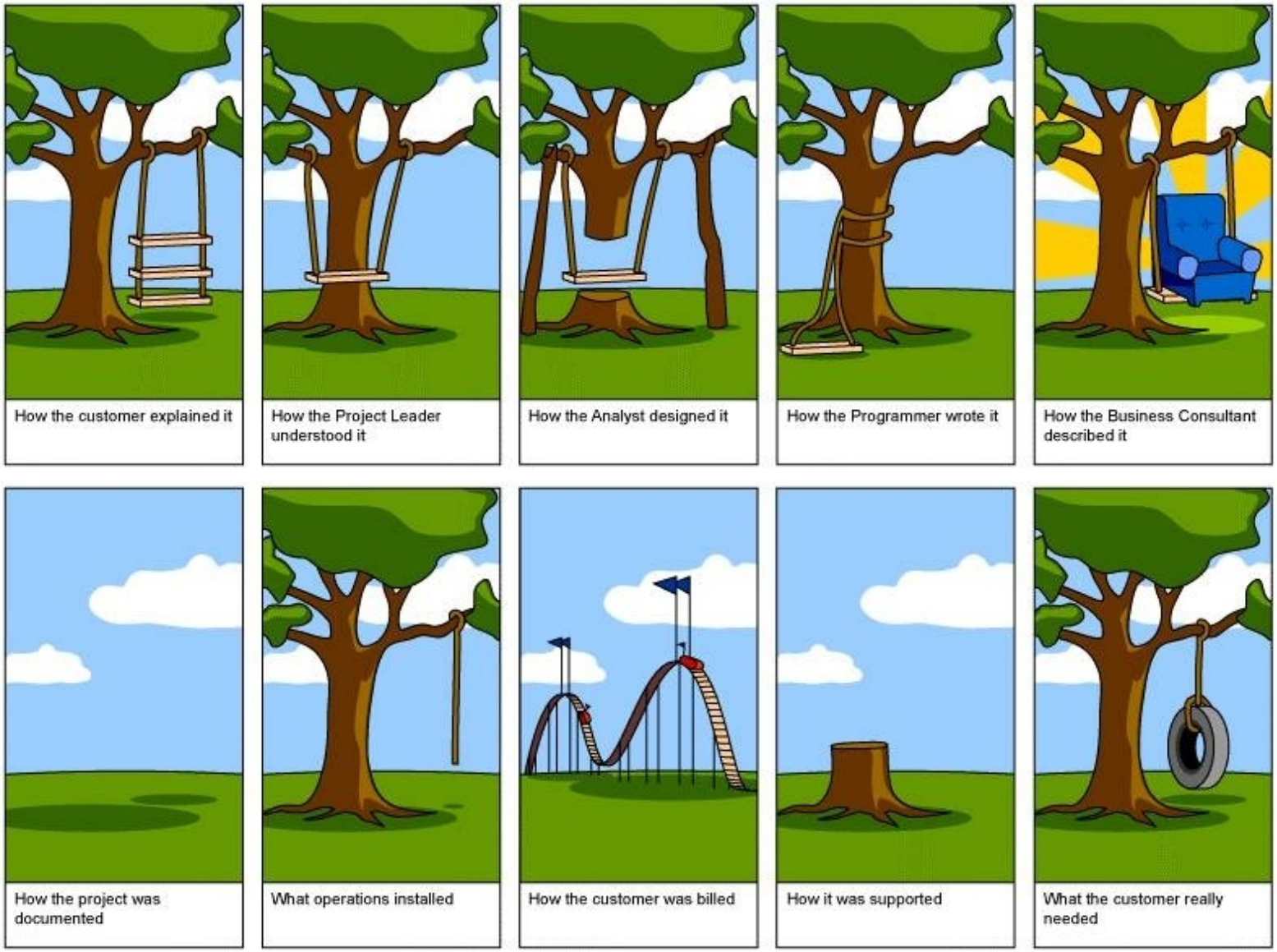
- Pilot experiments

- *Stakeholder analysis*
- *Questionnaires*
- *Interviews*
- *Observation*
- *Task Demo*
- *Ask suppliers*
- *Domain workshop*
- *Personas*

Stakeholder-based

- Systemic Thinking
- Brainstorm
- Creativity workshop



Origins unknown. Variations have circulated since the 1960s.

Stakeholder-based elicitation

"You have two ears and one mouth. I suggest that you use them in that proportion."

—G. K. Chesterton

Analyze current users

- To understand the problem, analyze existing “system” if possible:
  - Questionnaires
  - Interviews
  - Observe current users/apprenticeship

- The goal is to find out:
  - What is used, what isn’t, what’s missing.
  - What works well, what doesn’t.
  - How the system is used, how it was intended to be used, what new ways we want it to be used.

Questionnaires

Questionnaires are useful when information has to be gathered from a large number of people, particularly users.

- Closed questions (to gather opinions)
- Open questions (to gather suggestions)

Interviews

Interviews are useful for asking targeted, stakeholder-specific questions.

- Elicit stakeholder-specific ideas, opinions
- Elicit details that only the stakeholder can answer

Want to phrase questions as open questions, to elicit more details from the stakeholder

- who, what, when, where, ***why***

Good listening skills means focusing on what the stakeholder is actually saying; giving the stakeholder some time to articulate an answer

Interview Guidelines

- Set the interview in context
- Limit the duration of the interview (60-90 min) and stick to it
- Start with stakeholder background, goals
- Follow with use-case specific questions
  - Appropriate responses to business events
- Feedback your understanding of stakeholder's answers
  - Involve stakeholder in model building
  - Encourage stakeholder to change models
- Use the stakeholder's terminology
- Write down everything you are told
- Thank the stakeholders for their time

Common interviewing mistakes

- Not interviewing all of the right people.
- Asking direct questions too early.
- Interviewing one-at-a-time instead of in small groups.
- Assuming that stated needs are exactly correct.
- Letting one person dominate a group discussion

Ethnographic analysis

Ethnographic analysis is direct, first-hand observation of user behaviour

- An attempt to discover the social/human factors in a system.
- Studies have shown that work is often richer and more complex than suggested by simple system models derived by interviews alone.
- Can identify the used and critical existing features
- But focuses on existing solutions

© 2002 Michael Neugebauer

Apprenticeship

- Apprenticing is based on the idea of masters and apprentices
- The apprentice sits with the master craftsman (the user) to learn the job
  - By observation, asking questions, doing some of the job under the master's supervision.
- While working that the user can:
  - describe the task precisely
  - explain why the task is done this way
  - list the exceptions that can occur

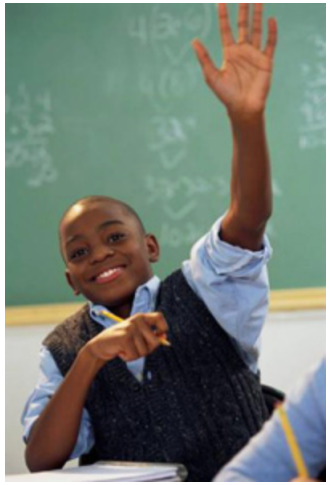
© 1940 Walt Disney

Personas

Personas are useful when real users are not available or are too numerous to interview them all.

- Important class of user, with unique needs and characteristics
- Include enough details (including a name!) to make the persona seem real to the team

Ken
(the keener)



Dudley
(the distracted)

Creativity-based elicitation

Idea: To invent undreamed-of requirements that bring about innovative change and gives competitive advantage.

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- *Creativity workshop*

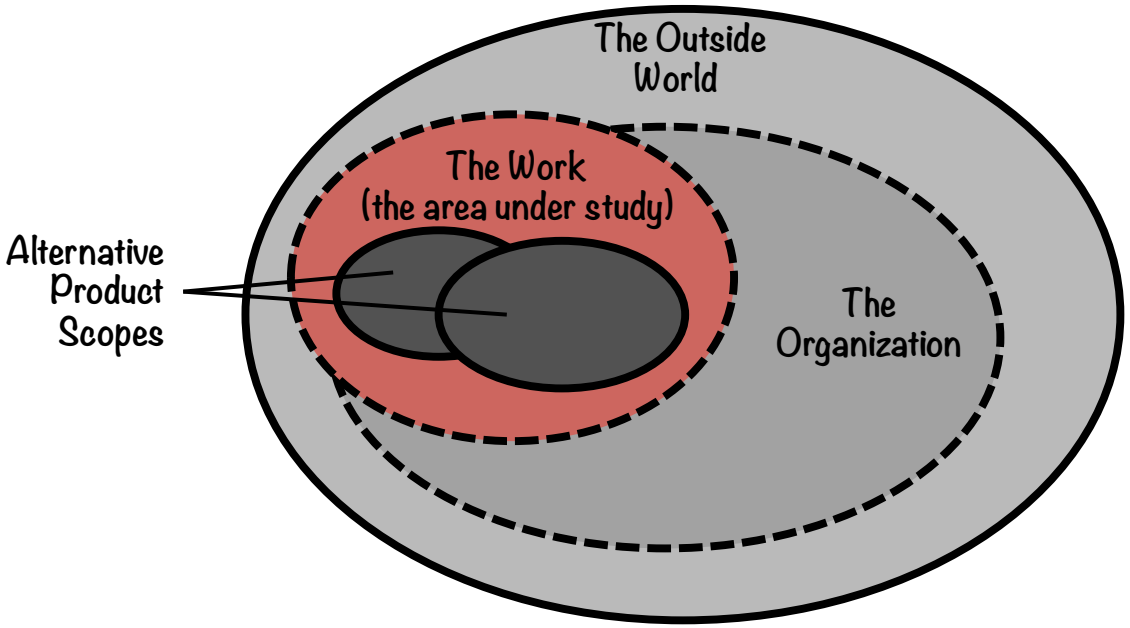
Creativity-based

Innovation

"Our job is to give the client, on time and on cost, not what he wants, but what he never dreamed he wanted; and when he gets it, he recognizes it as something that he wanted all the time."

—Denys Lasdun, architect

Systemic Thinking



Robertson, Robertson, Mastering the Requirements Process, 2012, Figure 3.3.

Thinking systemically about the Work (and not just the future system)

Brainstorming

Brainstorming is a group creativity technique designed to generate a large number of new ideas

Goals:

- Want to hear ideas from everyone, especially unconventional ideas.
- Creativity to be encouraged

Part I — Idea Generation

- Goal is to generate as many ideas as possible.
  - Quantity, not quality, is goal at this stage
  - Look to combine or vary ideas already suggested
- Scribe writes down all ideas so that all can see them

  e.g., whiteboard, paper taped to wall

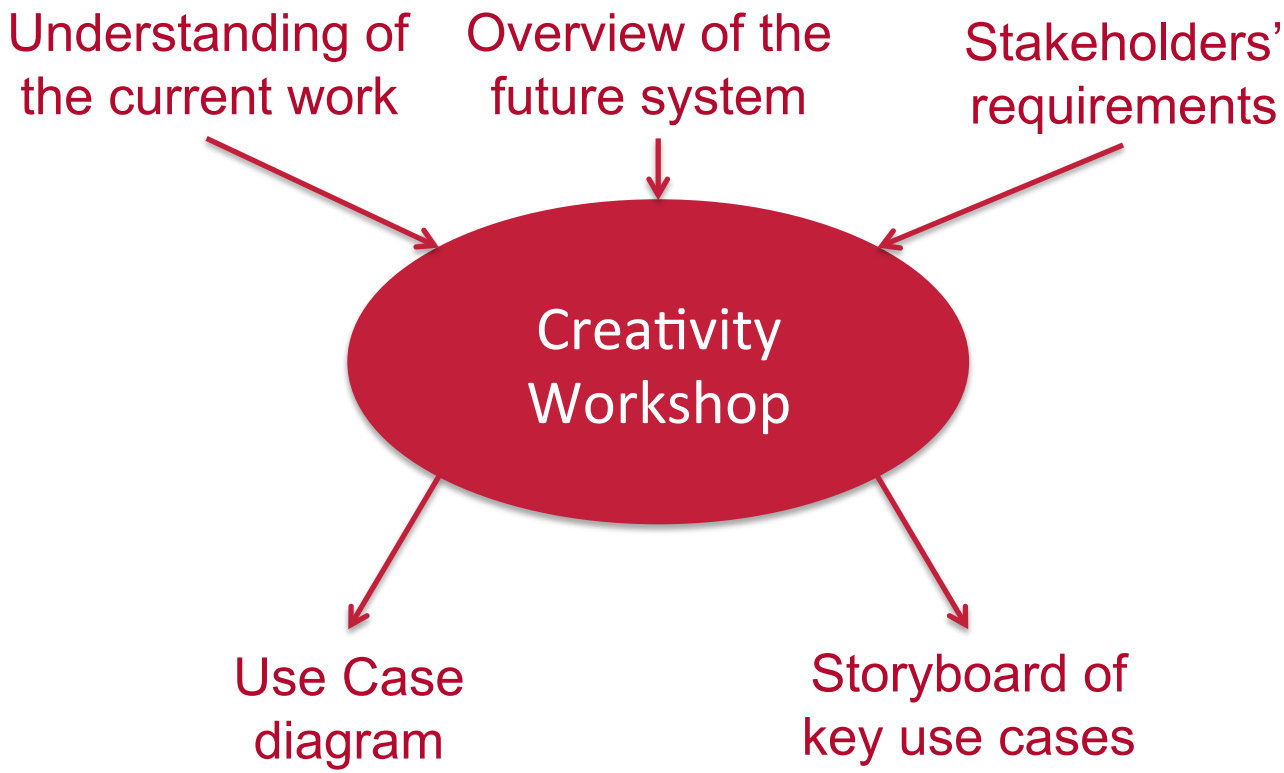
Part II — Assessment

As a separate activity, possibly involving a different set of stakeholders…

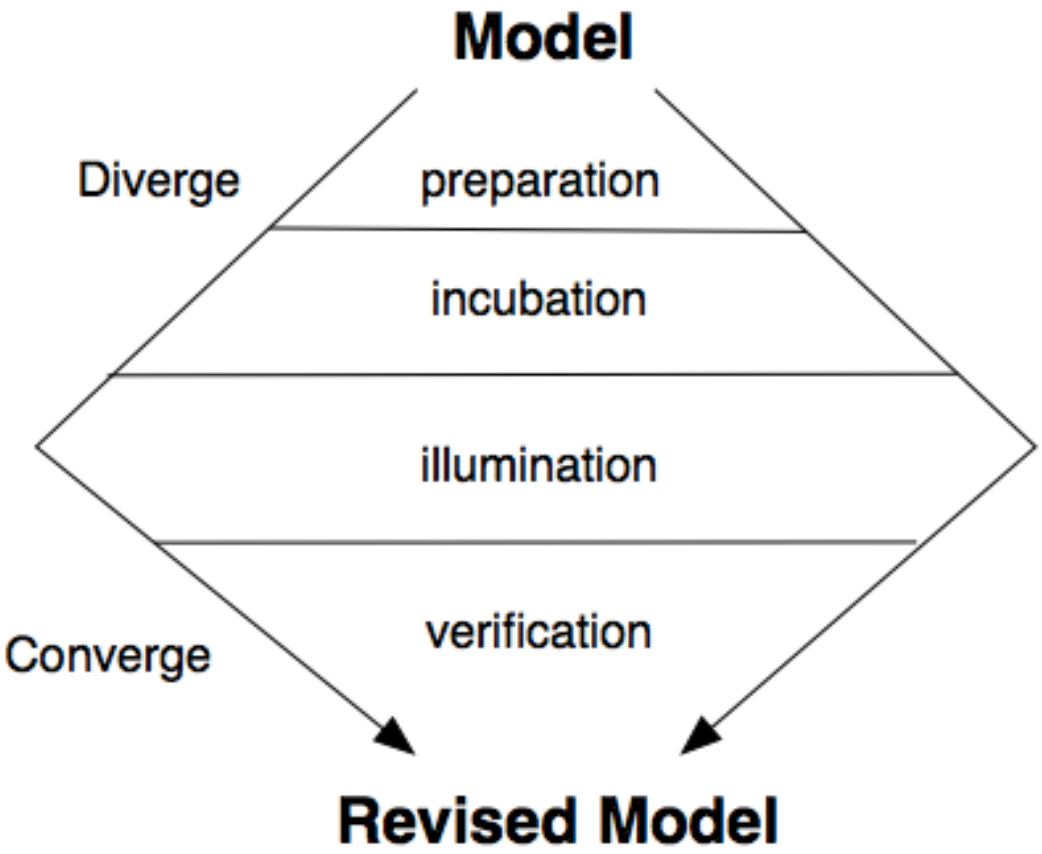
- Go over the list and explain ideas more carefully
  - Review, consolidate, combine, clarify, expand.
- Rank ideas and choose winners
- Be careful about time
  - Creative / technical meetings tend to lose focus after 90 min.
  - Take breaks or reconvene later.

Creativity Workshops

A risk-free space for creating and inventing news ideas – over and above the stakeholders' expressed requirements.



Creativity Workshops



Adapted from N. Maiden and S. Robertson, "Integrating Creativity into Requirements Processes", International Requirements Engineering Conference, 2005.

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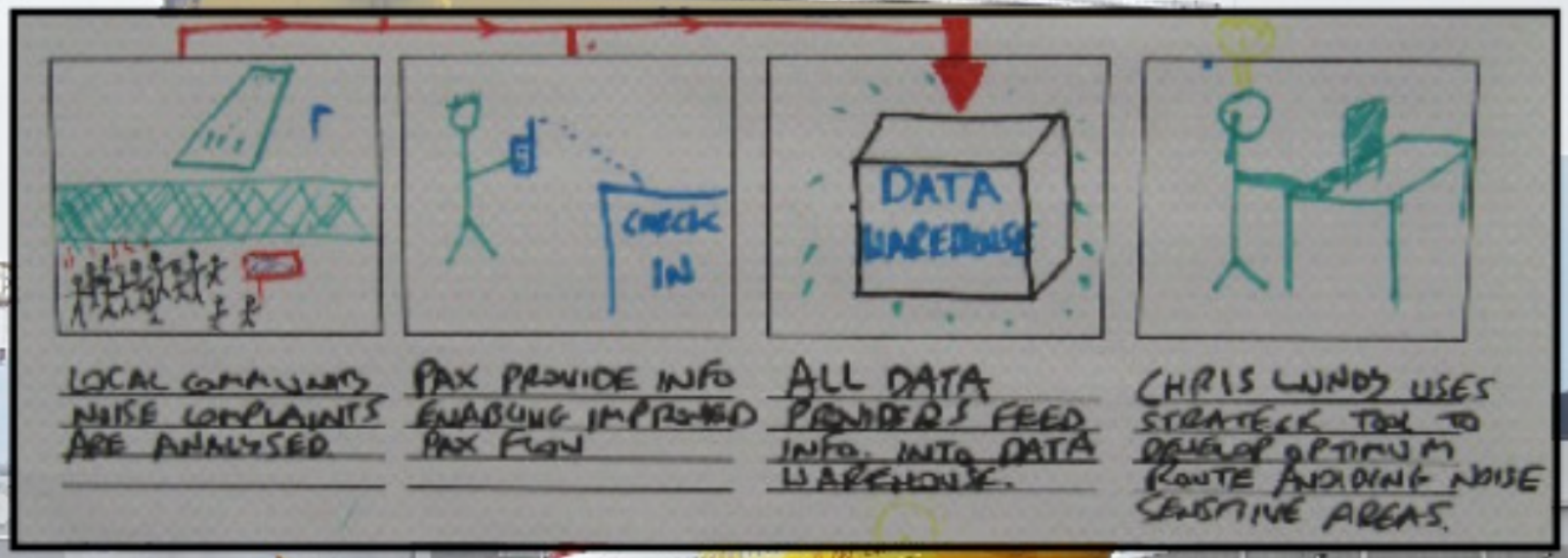
A Real-World Example

Removed key constraint: weather variability

Steam catapults; glided approaches; weather-adapted approach routes



.. not what they wanted, but what they never dreamed they wanted..

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A Second Real-World Example

Specifying concept for new conflict resolution support

- Indian textile expert encouraged incubation about requirements on patterns
- French ATCos highlighted need for aesthetics in generated resolutions

..not what they wanted, but what they never dreamed they wanted..

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A Third Real-World Example

Rich storyboards to describe concept of operation for multi-sector planning

- Complete system view
- Film screenplay techniques
- Constructed 2 large storyboards for whole system over 4 hours period
- Participants invented semantics of storyboard
- Tactile and flexible
- Ownership important

.. not what they wanted, but what they never dreamed they wanted..

Creativity Workshops

Creativity-based elicitation techniques include

- Open brainstorming
- Analogical reasoning: exploring analogies to a related problem
- Combining ideas
- Exploring new possibilities that result from relaxing identified constraints

Managing Expectations

Elicitation Techniques

	Early elicitation	Detailed elicitation	Elicit existing requirements	Elicit new and innovative requirements
Document Analysis				
Questionnaire				
Interview				
Ethnographic Analysis				
Modelling				
Prototyping				
Brainstorming				
Creativity Workshop				

Summary

Elicitation is hard

- It's common to use a physically violent metaphor for elicitation, like extracting a painful tooth or trawling for tuna.
- It is through the acts of *discussing, analyzing, modelling, reviewing, negotiating over, inventing, synthesizing,* and *explicitly documenting* that the various stakeholders come to a mutual understanding and agreement about what the real requirements are (and are not).

Deliverable #4

- (10%) Updated Use-Case Diagram
- (40%) Process Model (or Activity Diagram)
  - one model per use case (N key cases for a team of size N)
  - cite the source of the requirements for each process/activity
- (50%) Scenarios
  - one scenario per use case (N key cases for a team of size N)
  - use the scenario template provided in the lecture slides
  - include at least 4 notable alternatives and 2 notable exceptions per scenario
  - cite the source of the requirements for each step in the scenario's normal case, alternatives, and exceptions

your models should reflect requirements that are elicited from at least two (2) concrete stakeholders using at least four (4) different elicitation techniques