

Families Task 2.3

Method Selection in Requirements Elicitation

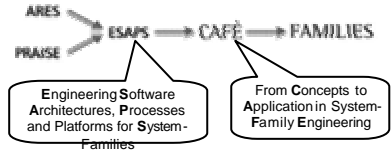
Zheyang Zhang

Zheyang.Zhang@cs.uta.fi

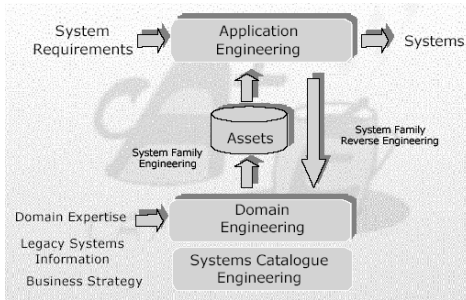
ITEA-funded FAMILIES project (2003 - 2005)

FAMILIES

- Fact-based Maturity through Institutionalization Lessons-learned and Involved Exploration of System-family engineering
- The project concentrates upon maturity, institutionalization, business relevance, standardization and dissemination, which is carried out by a consortium of leading European companies, research and technology transfer institutions and universities.
- <http://www.esi.es/en/Projects/Families/> (-> Dissemination)



System family engineering concept diagram



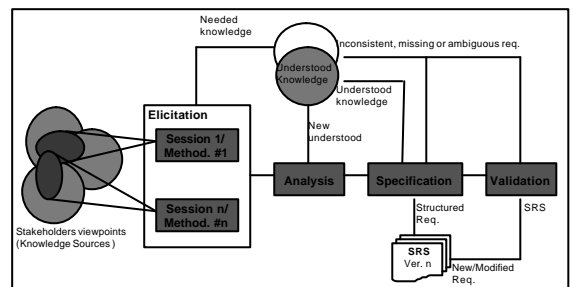
Work packages in FAMILIES

- **Reuse economics and family transition**
 - to consolidate economical and technical issues regarding the adoption or transition of system family engineering practices
- **System family maturity**
 - to merge the existing CMMI and CAFÉ process frameworks into a single system family maturity framework with an ample consensus from industry
 - 2.3 Tool support framework
 - Methods/techniques in requirements development
- **Family Quality**
 - to provide a set of techniques and methods that guarantee the quality of system families in an organizational context and addressing new challenges
- **Model driven family engineering**
 - to consolidate the system family engineering into a model-driven approach
- **Families Integration**
 - to introduce reuse across family boundaries
- **Dissemination**
 - to build European system family community

Introduction & Problem Description

- **UNA (Unified Nokia Approach) is a system engineering methodology for solution creation focusing on**
 - Process and domain modeling
 - Requirements development
 - Systems architecture definition and design
- **UNA consists of activities, practices, and methods performed to capture, analyze, transform, and synthesize the work products created during the product development process**
- **UNA aims at**
 - common way of working for systems engineering
 - clear definition and documentation of work products
 - systematic requirements development process
- **A set of methods are needed to define a common/formal way to process and document the work products at the requirements stage**
 - Stakeholder analysis
 - Requirements elicitation
 - Requirements analysis and purification
 - Feature specification

Requirements development



Requirements elicitation methods



- **Understanding requirements elicitation methods and foreseeing the need to use them in different contexts are essential for requirements elicitation**
- **Related research of requirements elicitation methods**
 - Byrd, T.A., Cossick, K.L. and Zmud, R.W. A Synthesis of Research on Requirements Analysis and Knowledge Acquisition Techniques. MIS Quarterly, 16 (1), 117 - 138
 - Coughlan, J. and Macredie, R.D. Effective communication in requirements elicitation: A comparison of Methodologies. Requirements Engineering, 7, 47 -60.
 - Maiden, N.A.M. and Rugg, G. ACRE: Selecting Methods for Requirements Acquisition. Software Engineering Journal, 11 (3), 183 - 192.
 - Hudlicka, E., Requirements elicitation with indirect knowledge elicitation techniques: comparison of three methods. in Requirements Engineering, (Colorado Springs, CO, 1996), 4 - 11.
 - Christel, M.G. and Kang, K.C. Issues in requirements elicitation Technical report CMU/SEI-92-TR-12 ESC-TR-92-012, Carnegie Mellon University, Pittsburgh, PA, 1992, 80

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Different groups of requirements elicitation methods



Requirements methods are categorized in line with the means of communication and the type of stakeholder

- **Conversational methods**
 - Verbal communication
 - + Practical and efficient to elicit non-tacit knowledge
 - + Labor intensive
 - E.g. Interview, Workshop, Focus groups, Brainstorming
- **Observational methods**
 - Observing human activities
 - + Elicit tacit knowledge and understand complex societies
 - + Time-consuming, normally hard to specify and analyze observer's perception
 - E.g. Observation, Social science, Ethnographic study, Protocol analysis
- **Analytic methods**
 - Exploring documentation and experts knowledge
 - + Elicit domain requirements for a product family
 - + Lack of user involvement
 - E.g. Documentation studies, Content analysis, Requirements reuse, Laddering, Card sorting, Repertory grid
- **Synthetic methods**
 - Combining conversation, observation, and analysis into a coherent method
 - E.g. Scenarios, Passive storyboards, Prototyping, Interactive storyboards, JAD/RAD session, Contextual inquiry

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Conversational methods



Method	Conductor	Description
Interviews	An experienced engineer with generic knowledge about the given application and its development Domain	Requirements engineer discusses the desired product with different groups of people and builds up an understanding of their requirements. If the interview is conducted with pre-defined agenda and questions, it is called structured interview; otherwise, it is an open-ended interview.
Workshops, Focus Groups	An experienced outside facilitator	Stakeholder representatives gather together for a short but intensely focused period to create or review high-level features of the desired products.
Brainstorming	An experienced outside facilitator	Stakeholder representatives gather together and rapidly develop a large and broad list of ideas. It encourages "out-of-the-box" thinking without normal constraints, and involves both idea generation and idea reduction.

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Observational methods



Method	Conductor	Description
Social analysis, Observation, Ethnographic study	The observer must be accepted by the people being studied as a "kindred spirit" and must be sufficiently familiar that they carry on with their normal practices as if he was not there.	An observer spends a period in a society or culture, making detailed observation of all their practices.
Protocol analysis		A subject is engaged in some task, and concurrently speaks out loud and explains his thought.

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Analytic methods



Method	Conductor	Description
Requirements Reuse	Analyst	Reuse of the glossaries and specification of legacy systems or systems within the same product family to identify requirements of the desired system
Documentation studies / content Analysis	Analyst	A common method consisting of reading and studying available documentation for content that is relevant to and useful on the requirements elicitation tasks.
Laddering	Analyst & Expert	It involves the creation, reviewing and modification of hierarchical content of expert's knowledge, often in the form of ladders (i.e. tree diagrams).
Card sorting	Analyst & Expert	The expert is asked to sort into groups a set of cards each of which has the name of some domain entity written or depicted on it.
Repertory grid	Analyst & Experts	Stakeholder is asked for attributes applicable to a set of entities and values for cells in entity -attribute matrix

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Synthetic methods



Method	Description
Scenarios, passive Storyboards	It is an interaction session to describe a sequence of actions and events for a specific case of some generic task which the system is intended to accomplish.
Prototyping, Interactive Storyboards	It provides stakeholders with a concrete (although partial) model or system that they might expect to be delivered at the end of a project. It is often used to elicit and validate system requirements.
JAD/RAD Sessions	It stands for Joint Application Development/Rapid Application Development and emphasizes user involvement through group sessions with unbiased facilitator.
Contextual inquiry	It is a combination of open-ended interview, workplace observation, and prototyping. This method is primarily used for interactive systems design where user interface design is critical.

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Perspectives of methods selection



- **Requirements abstraction level**
 - Generic problem analysis
 - Specific product description
- **Requirements source**
 - Human being
 - Other environments
- **Communication obstacles**
 - National culture
 - Organizational culture
 - Individual cognitive limitation
 - across time and space
- **Requirements certainty**
 - Well-structured problem domain
 - Unstructured problem domain

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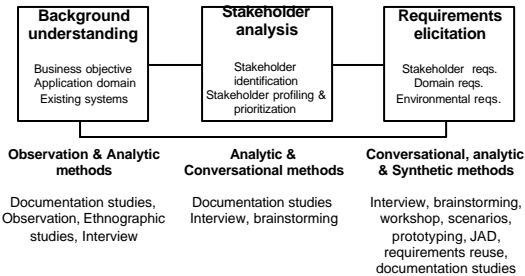
Method matrix



Perspective		Conver. methods	Observ. methods	Analytic methods	Synthetic methods
+++: Methods strongly recognize the issue and provide a means to deal with it. ++: Methods support the issues, but not as strongly as the previous one. +: Methods address the issues, but weak or indirectly. -: Methods do not address the issues.					
Abstraction level	Problem analysis	++	+++	++	+
	Product description	++	+	++	+++
Requirements Resource	Human being	+++	+	+	++
	Other environments	+	+++	++	+
Communication Obstacles	National culture	++	+	+	+++
	Organizational culture	+	+++	++	+
	Cognitive limitation	++	+	+	++
	Geographically distributed environment	++ teleconference	+	+	+
				email	groupware tools
Level of certainty	Existing domain	+++	+	+++	++
	New domain	++	++	+	+++

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Example: A generic strategy to select requirements development methods



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Characteristics of elicitation methods



- **Objectives**
 - The goals intended to be attained by using the method
 - e.g. Brainstorming: Rapidly develop a large and broad list of ideas; encourage "out-of-the-box" thinking without normal constraints
- **Knowledge sources**
 - The applicable knowledge source
 - e.g. representative stakeholders
- **Preconditions**
 - An assumption that is taken for granted to use the method
 - e.g. Group of participants, a meeting facilitator, meeting time and place is scheduled and informed, etc.
- **Postconditions**
 - The fact that must always be true after the method is performed completely
 - e.g. No more potential idea from participants
- **Process**
 - Main activities
 - e.g. idea generation and idea reduction
- **Work products**
 - The form of output and the type of knowledge
 - e.g. informal list of potential ideas
- **Interdependent methods**
 - Other methods that are used together with the method in common situation
 - e.g. documentation studies
- **Strengths**
 - e.g. good for eliciting user's needs
- **Limitations**
 - e.g. unsystematic

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Summary



- **Requirements development needs support of methods and tools**
- **Selecting proper methods for requirements development improves the quality of work products, which further improves the reusability of work products**
 - The conversational methods are handy, and applicable in most situations when stakeholders are people.
 - The observational methods work perfectly at the beginning of a development project to achieve the basic understanding of the physical, organizational, political and cultural environment.
 - The analytic methods is to reuse the corporate knowledge that exists in different forms. They shall be emphasized in requirements engineering for product families.
 - The synthetic methods are comprehensive. They are a good choice when the project resources allow.

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Future research



- **Empirical study of the elicitation method matrix**
- **Analytic methods in systems family engineering**

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