

USING CONCEPT MAPS AS REQUIREMENT ELICITATION TOOLS TO SUPPORT AGILE METHODOLOGIES

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Abstract. Software development requires close collaboration between clients and developers in order to ensure that a company's view of a software project can be realized correctly, as an actual application. Appropriate interaction between these two pillars, client and developer, is fundamental to the success of any developing project. This communication is supported by several techniques that constitute the *Requirements Elicitation* process. Beyond the several known techniques for requirements elicitation, this work proposes to research the use of Concept Maps as an alternative resource for the elicitation process.

1 Introduction

Good software development depends on the clear and complete understanding of its requirements. From this perspective, the study of Requirements Engineering is fundamental for the process, as it is responsible for the determination, specification and refinement of system and user requirements. Through requirements engineering, developers can coordinate with their clients in order to provide alternative and consistent solutions for the project. The elicitation process is traditionally done through a number of techniques. In this paper a complementary method is proposed where Concept Maps (Novak, 1984) are used as the primary tools for knowledge elicitation and representation in the elicitation process (Beuter, 2003).

2 Requirements Engineering

The requirements engineering is a phase in software development characterized by problem analysis via observations and information checking (Zanlorenci, 1998). The identification and determination of the requirements of a system are important tasks in Requirements Engineering because all requirements provided are used as structural basis for the services and restrictions presented by the system (Leite & Lucena, 1998; Sommerville, 2001). They are characterized by everything that must be discovered before the design of the product (Robertson, 1999).

The process of requirement elicitation involves a breadth of activities to determine the requisites necessary for a specific system (Kotonya, 1998). The process of requirement elicitation presents difficulties that can lead to a number of syndromes, often classified into three different types by (Leffingwell, 2000): the "Yes, but" syndrome, the "Undiscovered Ruins" syndrome and the "User and the Developer" syndrome.

The extraction of requirements is fundamental for the understanding of the problem domain. In table I, different elicitation techniques can be used for the process. The selection of a specific technique will depend on the type of application, the capabilities and sophistication of the group and clients, the scale of the problem and the chosen technologies (Leffingwell, 2000; Beuter, 2003).

Elicitation Technique	Advantages	Disadvantages
Interview	Shares Experiences; Makes it possible for different perspectives to the problem, allows direct interaction between client and developer; Is supported by questionnaires.	Subject to the syndrome of the user and developer; Incompatibilities between client and developer, delays on the execution of the process; Lack of clarity from answers; Difficulties in the interpretation process.

Elicitation Technique	Advantages	Disadvantages
Workshops	Promotes a consensus on requirements; Short time periods; Enables the stakeholders to express their thoughts on the problems; Alternatives for the problems are jointly discussed; Enables the introduction of the system; promotes the conscientization of all corporate members.	Identification of resistance to improvements; Promote poorly planned or badly structure workshops.
Brainstorming	Facilitates the creation of new ideas; Allows for the refinement of ideas; Brings together groups of people that are interested in the same subject.	Delays in the execution of the process.
Scenarios	Identifies the requirements and their interactions; Uses a lexical language; Easy understanding, independent from user background; It is based in real situations.	Generates a large volume of information; Makes it difficult for the research of specific aspects.
Use Cases	Is influenced by the scenarios; Describes interaction between users and systems; Identifies all actor involved in the system; Emphasizes the benefits of the system.	Specifies only functional requirements; Shows only distinct parts of the system.
Storyboards	Shows the problem through PowerPoint; Enables emulation and simulation; Practical interaction.	Tendency to create the syndrome of the "Yes, But".
Ethnography	Understands the work and needs of the users; Describes the context of the organization and all activities; Verifies the perspectives of all people involved with the organization.	Incipient; Delays in the execution of the process.
Role Playing	Understands the problem through user experiences and perspectives.	Difficulties in the understanding of the procedures, as users tend not to reveal common working procedures.
Prototypes	Shows the requirements of the system in order to facilitate the understanding of the users and developers; Enables the construction of a product by parts; Reduce costs; Identifies inconsistencies.	Development of costs; Development of projects is time consuming and prototypes ore often incomplete.
Document Archeology	Research through company documents.	Inexistence of company documents.

Table I: Comparing Elicitation Techniques

3 Concept Maps

Concept maps are schematic graphs used for the representation of knowledge through the use of concepts and propositions (Cañas, 2002; Novak, 2002). Concept maps can be used in the phase of requirement elicitation as they facilitate a better understanding of the problem domain

To structure of a concept map is usually hierarchical. Concepts are organized from more general at the top, to more specific at the bottom of the map. Concepts are connected with linking phrases that specify their relationships. Concept maps are based in the Meaningful Learning Theory from David Ausubel. The Meaningful learning theory emphasizes that a topic must be explored through the concepts that show explicative power. It is influenced by everything the apprentice already knows (Faria, 1995; Konrat, 2002).

Ausubel's theory states that it is easier to develop concepts when starting from general elements to more specific elements. This way, it is possible to detail the specificity of each concept. All refinements of concept to another are detail through two principles defined as progressive differentiation and integrative reconciliation (Moreira, 1982).

4 Application

A service contractor in informatics was chosen as a case study for the proposed approach. The name of the Sao Leopoldo-based company is NAVEGUE.COM. Three techniques were used for the creation of the concept maps for requirement elicitations: interviews, scenarios and use cases. After a requirement elicitation process, using the traditional techniques previously discussed, a conceptual map describing a global context of the company NAVEGUE.COM was created (Beuter, 2003). Figure 1 shows part of the concept map.

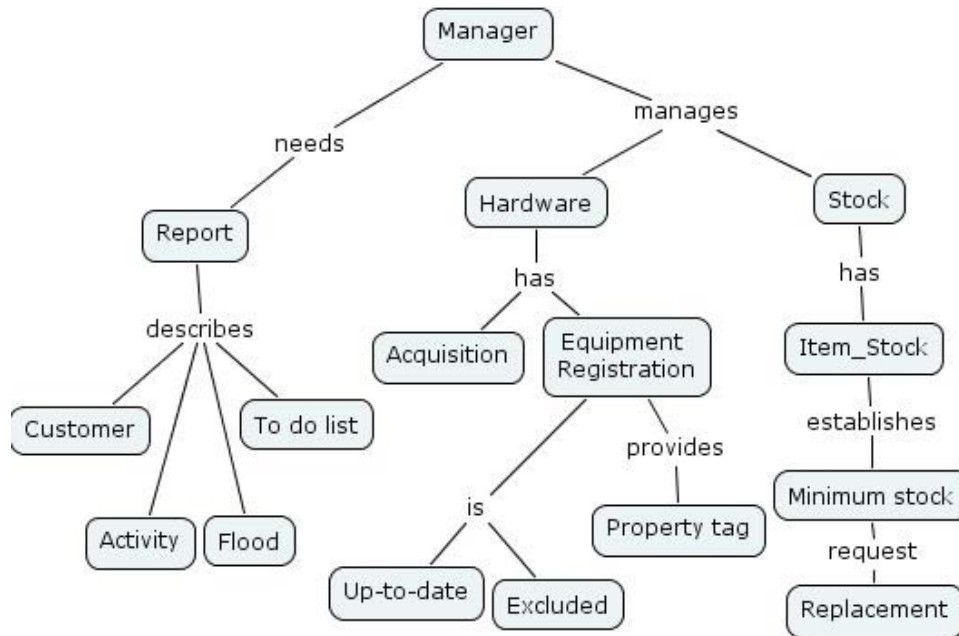


Figure 1. Partial Map of the Company NAVIGUE.COM, translated from Portuguese for this publication.

The concept map in figure 1 shows, for instance, that the “manager” must have access to reports with information about clients “customer”, reports about services provided by the company “activity”, accounting information “flood” and information about clients with outstanding payments “to do list”. The “manager” also coordinates all the company’s hardware and performs analysis and future purchases (“acquisition”). “Hardware” control involves the “Equipment Registration” which will, in turn, result in the creation of a “property tag”. The “manager” also needs access to a “Stock” module, which provides control over stock items (item_stock) and “minimum stock”. When the minimum stock level is reached, the system will automatically request new purchases for replacement.

Our experience on using concept maps for knowledge elicitation has shown that it usually takes several iterations and reviews to build a good map. This first approximation of one of the maps designed for NAVIGUE.COM, although simple, was extremely valuable to improve and clarify communications between parties. Both, customers and developers recognized the benefits and the value of using concept maps for the requirement elicitation phase.

5 User Stories: Proposal for future job

Among the methods that excel because of their organizational alignment, we point out Extreme Programming - XP. XP technique shows itself like a dynamic and quick way of developing software providing least documentation. XP is an efficient, flexible and affordable approach for small and medium size teams working on projects where requirements are in constant transformation (Vidotti, 2003).

User Stories	Conceptual Maps as User Stories
Short description	Rich in details
Individual construction	Collective construction
Little interaction at working out User Stories	Great interaction at creating the Map that contains requirements information
Difficult updating	Permanent updating
Interaction based on the writer's writing style	Collective interaction because everybody participates in the creation of the User Story based on conceptual Maps
Document of difficult distribution among the Stakeholder	Document in the net and extremely easy to be obtained
Textual description	Description with multi-media resources

Table II: Comparing Elicitation Techniques

XP developing team works in pairs all the time and all members are responsible for code improvement and alteration. Along with the team, client's participation is remarkable because he helps in identifying the requirements through the user stories. That is, in the user stories, the user describes the desired behavior for the future system (Jeffries, Anderson & Hendrickson 2001).

From this perspective, we claim that concept maps can be used as the main technique in these environments, support by the requirements elicitation process, having the user stories as base. In table II, a short comparison between conventional User Stories techniques and the proposed concept-map augmented approach is presented.

6 Conclusions

All applied techniques reached the goals of the project and were fundamental for its development. However, the high demands in time, the high volumes of information and fragmented representation are factors that can compromise the understanding of the desired system. During the elicitation phase, the engineers needed to understand the problem to be solved. For that, the responsibility of the engineers and analysts was the identification of the main ideas of the system that is the key concepts, in order to reorganize all the information and create a solution. Given all these issues, a methodology for expressing the knowledge of the system as a whole in a clear and simple way was proposed through the use of concept maps as a tool for the elicitation process.

The goal of this research is not to invalidate the traditional techniques widely used for requirement elicitation. The goal is recommend an alternative methodology that will enable the visualization of requirements as whole and that can used as an artifact in the process of requirement elicitation.

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