

Developing a Survey to Collect Expertise in Agile Product Line Requirements Engineering

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Abstract

The need to rapidly deploy high quality families of software products has lead researchers and practitioners to investigate how to integrate agile methods and product line engineering techniques in multiple phases of the software development lifecycle. Our research focuses on the requirements engineering (RE) activities. In particular, we are investigating how to select a requirements engineering process that provides the necessary degree of agility and support for specifying a product line application. As a first step in this research, we have designed a questionnaire for gathering from experts the knowledge that influences the RE process selection. Here we describe the development methodology and provide an overview of the questionnaire.

1. Introduction

The need to rapidly develop high quality, complex software continues to drive research in a number of (separate) areas in the software engineering community. For example, software product line development techniques have been of keen interest as means to re-use and tailor technical assets including models (requirements specifications, design), implementation, and test cases. A main focus in this area is to effectively create sets of related products by re-using and tailoring managed assets. Agile development techniques have also been proposed to rapidly develop software by focusing on developing working code; they seek to minimize the amount of documentation, process definition, and model development. It is interesting to note that although the goals of the two techniques have similarities (rapidly

develop high quality, complex software), there are just a few attempts to link both disciplines [3].

The goal of our research in progress aims at applying agile principles and techniques into product line engineering, leading to approaches that increase the productivity of the development teams, reduce products' time-to-market and development costs, and improve customer satisfaction.

As a first step towards this goal, we are investigating the current state of the art with focus on requirements engineering (RE). We have designed a questionnaire with a twofold aim: 1) find out which are the current practices in agile product line RE; 2) know how experts would react in particular scenarios of the domains they use to work. The presentation of the questionnaire is the motivation of this short paper.

The structure of the paper is as follows. The questionnaire development methodology is presented in Section 2. The questionnaire is discussed in Section 3. Conclusions and future work are in Section 4.

2. Methodology

The questionnaire was systematically developed. The main steps were to establish background knowledge in the area, specify, implement, beta test and disseminate the questionnaire. Each of the main steps involved a number of sub-activities, including reviews and revisions to ensure the quality of the work.

2.1 Background

Several activities were performed to establish a solid foundation for this research. The first activity was to carry out a rigorous literature survey in three key areas: Requirements Engineering (RE) approaches in Agile Methods, RE approaches in Product Line

Engineering, and established work in the area of questionnaire design. For the literature survey for RE in agile and product line engineering approaches, 66 articles and books were considered. Two main sources [2][7] were utilized to identify the characteristics of a “good” questionnaire.

The second activity involved analyzing the 12 principles of agile methods [6] and ranking them with respect to their impact and relationship to established RE activities (elicitation, specification, analysis, validation, and management). The relationship of each principle to the RE activities has been ranked using three values: high, medium, and low. This analysis was necessary to focus the questionnaire on the appropriate area and elicit good questions to ask the experts. The detailed results of the analysis are available in [4].

2.2 Specify the Questionnaire

With the background in place, the next step was to specify the questionnaire. The questions and structure of the questionnaire were iteratively defined, reviewed and corrected.

Brainstorm/identify possible questions. A collection of possible questions is generated; an initial structure for the questionnaire is proposed. This activity is driven using the analysis of the RE activities with respect to the agile principles and the knowledge from the literature survey in agile methods and product line engineering techniques.

The results of the analysis of the RE activities [4] indicate that principles 2, 3, 6 and 10 are the most highly related (in addition 1 and 4 also rate careful attention in our questionnaire development). Principle 2 is to “Welcome changing requirements, even late in development” and Principle 3 is to “Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale” Principle 6 is “The most efficient and effective method of conveying information to and within a development team is face-to-face conversation”. Principle 10 is “Simplicity--the art of maximizing the amount of work not done--is essential”. These principles are used to derive questions, such as characteristics about the project size, geographic distribution, level of customer involvement, etc.

Propose Questions and Structure. Using “good” questionnaire design principles, questions/possible responses and the overall structure of the questionnaire are defined. Examples of “good” questionnaire design principles include a) begin with a few easy (non-threatening) and interesting questions that introduce the respondents to the questionnaire; b) group the

questions into logically coherent sections; and c) organize the questions into a meaningful order and format. Additional principles of designing a “good” questionnaire have been summarized in [4].

The overall structure of the questionnaire into two main parts converged rapidly, by the third iteration. For each main part, however, defining the finer grain structure and the specific questions required numerous iterations.

2.3 Implement the Questionnaire

The questionnaire has been developed as a web-based application, which allows for convenient, international access. It is implemented using C#; data from the responses are stored in a MySQL database. The questionnaire has been implemented in two major iterations. In each iteration a section of the questionnaire was implemented, reviewed (independently reviewed by non-developers on the team), and corrected. The first iteration was for Part I and the second iteration was for Part II. Part II of the questionnaire is currently under development. The current version is available at [1].

When the development for Part II has been completed, it will be beta tested; a set of 6 experts in the community has been asked to fill in the questionnaire. They will be provided with a review form to help identify issues, concerns and problems with the questionnaire. The beta testers have been encouraged to provide frank comments and critiques about the questionnaire.

Once the results from the beta testers have been collected and analyzed, the questionnaire will be updated and then disseminated to the experts in the community. Researchers and practitioners involved with program committees and/or participants at related workshops (e.g., APLE 2006, RWASE 2007, SPLC 2007) will be invited to respond. The data from the community will be collected, analyzed, and embodied in an expert tool. The tool will be made freely available via a website.

3. APLE Questionnaire

The questionnaire went through more than 20 iterations. The questionnaire is composed of a welcome screen, two main parts (Part I and Part II), and a closing screen. The welcome screen provides instructions on how to use the questionnaire; the closing screen provides additional contact information. The purpose of Part I is to collect the background/context for the expert’s opinion. The

purpose of Part II is to collect the expert's opinion on the agile and product line engineering requirements engineering techniques they would recommend for a set of project scenarios. The current version of the questionnaire is available at [1].

3.1 Part I: Collect Expert's Background

A total of 37 questions were defined and organized into seven subsections: project type (1 question), project domain (3 questions), project size (3 questions), project interaction with stakeholders (5 questions), project requirements (8 questions), agile requirements methods used (5 questions), re-use and product line methods used (12 questions).

The project type question asked if the expert's opinion was based on a new project, on-going project, or re-engineering a legacy system. Project domain related questions included, for example, identifying the level of expertise the organization had in the domain before starting the project, characterizing the application domain (e.g., finance, automotive), etc.

3.1 Part II: Collect Expert's Opinion

A total of 9 questions were defined for the respondent to answer for each scenario presented. This part of the questionnaire was more challenging to define than Part I. For example, the experts responding to our questionnaire are expected to have different backgrounds (domain, kind of project (embedded, information, etc.). Consequently, it was not possible to present a single set of scenarios and expect the experts to be knowledgeable in all of them. For example, someone who has applied agile product line engineering techniques on large-scale information systems (e.g., healthcare) was not likely to have substantial expertise developing embedded real time systems (e.g., automotive). We determined that it was necessary to define a large number of scenarios with different characteristics and select a set of highly related project scenarios to present to the expert. This implied dynamic scenario selection. To date, 162 project scenarios have been defined across 9 application domains [5]. Based on the experts' responses in Part I, a small subset (three to five) of scenarios is presented to the expert; an algorithm has been defined to select the best matching scenarios [4].

4. Conclusions and Future Work

In this paper we have presented the initial effort for assessing the state of the art on the use of agile

principles in product line requirements engineering. This effort takes the form of a questionnaire currently available at [1] whose design methodology and main characteristics have been outlined here. The development of the questionnaire has involved four Ph.D. and five M.Sc. and B.Sc. students belonging to two teams (one in the USA and one in Spain). The total effort in this first phase has exceeded 750 person hours.

The next steps are to complete the questionnaire development, beta test and update the questionnaire, and then advertise our questionnaire in several appropriate forums. We propose to collect and analyze data, embody the knowledge in an expert system, and validate the results on interesting case studies.

5. Acknowledgments

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6. References

- [1] *Agile Product Line Engineering Requirements Engineering Questionnaire*, available at: <http://129.110.92.41/Default.aspx>
- [2] Berdie, Doug R., Anderson, John F., Niebuhr, Marsha A. *Questionnaires: Design and Use*, 2nd edition, The Scarecrow Press Inc, 1986.
- [3] Cooper, K., Franch, X. (eds.), *Proceedings of the 1st International Workshop on Agile Product Line Engineering*, Aug. 21, 2006, Baltimore, Maryland, USA, available at <http://www.lsi.upc.edu/events/aple>.
- [4] Feng, K., Lempert M., Tang, Y., Tian, K., Cooper, K., Franch, X., "Developing a Survey to Collect Expertise in Agile Product Line Requirements Engineering Processes", Technical report, co-published as UTDCS-18-07 (UTD) and LSI-07-15-R (UPC), 2007.
- [5] Feng, K., Lempert M., Tang, Y., Tian, K., Cooper, K., Franch, X., "Defining Project Scenarios for the Agile Requirements Engineering Product-line Development Questionnaire", Technical report, co-published as UTDCS-21-07 (UTD) and LSI-07-14-R (UPC), 2007.
- [6] *Manifesto for Agile Software Development*, available at: <http://www.agilemanifesto.org>.
- [7] Oppenheim, O.N., *Questionnaire Design And Attitude Measurement*, Basic Books Inc., New York, 1966.