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Towards Group Decision Support in the Software Maintenance Process

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ABSTRACT

Software maintenance is a key element of the life cycle of software. However, the techniques of software maintenance do not consider the diversity and the complexity of decisions which do not stop increasing. So, there are at present a few tools, susceptible to insure the relevance and the efficiency of the decision-making in this phase. The work presented in this paper aims to eliminate or at least to reduce the effect to fall in an expensive change by reducing the time to find a compromise on the adequate change. The development of the decision support system for software maintenance is an answer to the problem. The developed tool allows one to make a fast diagnosis on the software by using the coupling metrics; to help the decision-makers of the maintenance, according to their preferences often conflicting; to adopt a change among several proposed. To answer this group decision where various points of view are considered, the authors propose a negotiation protocol. This protocol tries to find a compromise that suits best all the decision makers.

KEYWORDS

Coupling Metrics, Decision Support, Negotiation Protocol, Software Maintenance

INTRODUCTION

The maintenance is the last phase of the software life cycle, it is the most expensive phase. According to (Pfleeger & Bohner, 1990), Software maintenance is defined as the process of modifying the software system or components, to correct faults, to improve its performance, or to adapt to changes in the environment (Dhillon, 2002). The maintenance cost depends on the dependency degree between the entities of software architecture. A change can have considerable and unexpected effects on the rest of the system. The danger incurred during a modification is the change propagation. Therefore, it's better to have an idea of the software architecture to estimate the change impact and so reduce the maintenance cost. The modularity is considered as an important criterion of the software quality. A software product is said modular if its components present a weak degree of coupling. Within the framework of Object Oriented applications, there are various types of coupling between classes. Measuring these types of relations allows understanding better the link which exists between the coupling of the classes and the quality attributes (Aggarwal et al., 2006). We define a change in a program as a modification brought to one of its elements (class, method or variable). So, the impact is seen in our context as the consequence of a change. The impact analysis is an activity where the objective is to determine the extent of a change request. It estimates affected elements at the level of

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the source code. The more a class is coupled with other classes, the more it is sensitive to the changes made in these classes and the more it may undergo errors.

Several studies have been made in this direction. (Abdi et al., 2009), used a probabilistic approach, other (Cheikhi, 2005), worked on predicting the impact of change through machine learning, (Ren et al., 2004), developed a tool for assisting developers with program understanding and debugging. The common point is the use of coupling metrics as an indicator of impact analysis.

However, In the case of a decision making in maintenance process, coupling property is not the only indicator of maintenance, various activities such as understanding, readability and modification of programs are considered to be a factor in reducing the estimate of maintenance effort. The skills of software maintainers involve knowledge of the programming language. This factor includes the experience and familiarity of the maintainers with the latter so that the maintenance team can easily understand the system (de Souza, Anquetil, & de Oliveira, 2005) (Anquetil & de Oliveira, 2005).

In software maintenance, the managers are confronted to a problem of the group decision where several often conflicting points of view should be considered.

In the face of various proposed changes, the choice of the most relevant change is a complex problem, especially when we are in a group environment. In this context of research, the decision-making support in software maintenance is motivated by the lack of tools. Offering a tool which allows helping the managers in the choice of the change among several represent a financial gain to companies. The proposed approach allows the development of a decision support system collective which tries to bring an effective and rational solution. We exploit in our approach the advantages of the Multi-Agent Systems (Tučník, 2010), to model the decision-makers, so their interactions to arrive at a beneficial consensus by basing itself on a negotiation protocol.

PROBLEM AND CONTRIBUTION

With the evolution of the software systems, an important stream of changes must be taken in charge as well as their propagation in the rest of the system. Successfully changing the software of a disciplined way while maintaining its functioning and its integrity with a reasonable cost requires a change impact analysis before its implementation. Indeed, the team of maintenance has to be able to supply answers to the following questions: what type of change is it? What is the extent of the change? What are the criteria of the engineer?

In the management of the software projects, several changes can be proposed to solve the same problem at the level of code and satisfy the same need for the user of a software system. However, different objectives must be considered when it is about a group of decision-makers. For that purpose, we propose an approach of group decision making support which allows supplying the best assistant to facilitate the choice of a change, and so to optimize the cost. Minimizing the cost, is to minimize the time between the proposal of the change, its implementation, and its realization. Choose the right change in the right moment while considering the differences between the members of the group is a difficult task. This work aims to help a group of decision-makers in the choice of appropriate change by taking into account the interests of each decision maker to reach an agreement. In this context of research, the decision support system uses the advantages of the Multi-Agent Systems to represent the diversity of the actors implied in the decision. We endow the MAS module with a negotiation protocol based on mediation. This protocol includes an initiator agent responsible for the negotiation process and a set of participant agents. The agents represent the different actors of the management team of the maintenance involved in the decision. The final choice of change in this situation will be made after a process of negotiation. Section 2 reviews the works concerning the impact analysis, decision support systems and the reaching agreements in MAS. The third section is reserved for our approach. Section 4 explains the experimentation and implementation of the tool. The perspectives of this work are cited in the conclusion.