International Journal of Information Technology and Knowledge Management
July-December 2012, Volume 5, No. 2, pp. 315-318

A KNOWLEDGE BASED APPROACH TO ENHANCE SOFTWARE ARCHITECTURE REVIEW PROCESS

P.Shanmugapriya [1], R.M.Suresh [2]

ABSTRACT: The software architecture [SA] has received increasing attention as an important subfield of software engineering. The Software Architecture is the foundation for building any software and it is deciding the quality of software. Evaluating Software Architecture is a key part in software development. This paper intends to increase the consistency of software architecture evaluation process to a step ahead. The use of knowledge base system and the intelligent agent helps to achieve the consistency in Software Architecture Evaluation.

Keywords: Knowledge Base system, software architecture, intelligent agent

1. INTRODUCTION

"*The objective [*of software architecture review] *is to identify potential issues with a proposed architecture, prior to the construction phase, to determine its architectural feasibility and to evaluate its ability to meet its quality requirements.*" [6]. Architecture knowledge can mainly be classified in two categories, namely contextual and technical. The former is called design rationale (DR) [1, 2] and provides the answers to questions about a certain design choice or the process followed to make that choice [3, 4]. If it is not captured, knowledge concerning the domain analysis, patterns used, design options evaluated, and decisions made is lost, and so is unavailable to support subsequent decisions. The other type of knowledge is technical (such as patterns, styles, tactics, and analysis models) [8]. The researches [5-7] says that, when one aims to learn a fact to spot the individuality of a method, appropriate quality research methods and tools to be used. Such knowledge is required to design and evaluate architectures.

1 Research Scholar, Department of CSE, Scsvmv University, Enathur, Tamilnadu, India
2 Professor & Head – CSE, R.M.D College of Engineering, Chennai, India

The SAAM is the one traditional and key SA evaluation method [9, 10] guides the inspection of the architecture, focusing on potential trouble spots such as requirement conflicts or incomplete design specification from a particular stakeholder's perspective. Essential requirement of all these approaches is to describe architecture in terms of design decisions and DR surrounding them. However, design decisions and their rationale are not rigorously documented. One of the main reasons for this is lack of suitable methodological support.

2. Knowledge Base Intelligent Agent

Knowledge management (KM) is becoming a key management factor for enhancing decision making processes, shortening time, saving rework, and improving quality of products. KM mainly targets knowledge intensive processes that are critical to the organizational performance, such as SA, which embody knowledge and serve as vehicles for communication among stakeholders. In particular, SA captures early design decisions and it is a transferable abstraction of the system which enables further reuse in other software systems [1].An intelligent agent is one that is capable of flexible autonomous action in order to meet its design objectives. Reactivity: Intelligent agents are able to perceive their

environment and respond in timely fashion to changes that occur in tit order to satisfy their design .Pro-activeness: Intelligent agents are able to exhibit goal-directed behavior by taking the initiative in order to satisfy their design objectives. Social ability: Intelligent agents are capable of interacting with other agents in order to satisfy their design objectives [11]. It operates by storing sentences in its knowledge base, inferring new sentences with the inference mechanism and using them to deduce which actions to take.

3. Related work

The SA review process that was identified [12] is presented on Figure-1. One of the main problems caused by insufficient collaboration between stakeholders is the dis-attachment between the review process and the architecture process as well as among different review processes. Knowledge reuse, preservation and accessibility are vital for good, effective and efficient review process for making use of already constructed and proven knowledge and reducing time and other resources invested.

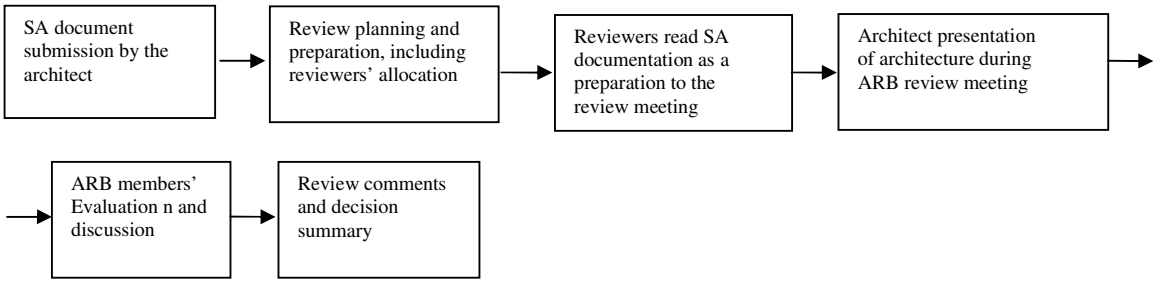

Figure 1: The SA review process (Referred from Sofia Sherman et al. 2010)

The objective of SAAM is to verify basic architectural assumptions and principles against documents that describe the desired properties of an application. This analysis helps assess the risks inherent in architecture. SAAM guides the inspection of the architecture, focusing on potential trouble spots such as requirement conflicts or incomplete design specification from a particular stakeholder's perspective. Additionally, SAAM helps compare candidate software architectures. Kazman et al. [10]

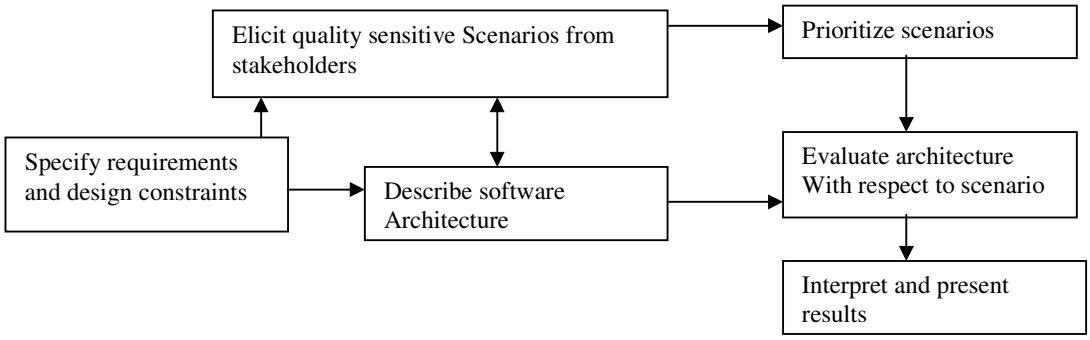

Figure 2: General activities in scenario-based evaluation methods
(Referred from Kazman et al 1994)

There are six activities in the SAAM which are shown in Figure-2 and discussed as follows: Specify requirements and design constraints, Describe software architecture, Elicit scenarios, Prioritize

Scenarios, Evaluate architectures with respect to scenarios and Interpret and present results. While describing the software architecture, Process Support Components are responsible for enacting process, providing guidance to the user, and ensuring that the user is aware of the current process state. The Architectural Editorial Components are responsible for viewing different kinds of architectural and non-architectural information. Central Data Repository is responsible for storing information and the Constraint Checker checks for constraint violations.

4. Proposed Framework for Software Architecture Evaluation Process

A proposed framework for Software Architecture Evaluation Process has been developed and presented in Figure-3. Initially the Software Architecture has been developed and submitted to the review board for Evaluation. The stakeholder's requirements may overlap or may be different from each other. The architect has to balance all these different perspectives and then come up with an architecture that satisfies all stakeholders to the maximum possible extent. The stakeholders have a significant influence on the architecture and their viewpoints are to be considered important while coming up with architecture for a system. The specialists in SA Evaluation, evaluates the submitted SA document and At that time they would have consider the priorities for the stakeholder's scenarios, Identifying potential risks, identifying opportunities for reuse, capturing the rationale for important design decisions, Partitioning architectural design responsibilities, find undetected design problems and identifying skills required to implement the proposed architecture. Finally the review board for SA Evaluation gives their Evaluation report and remarks which helps the architects to take necessary corrections.

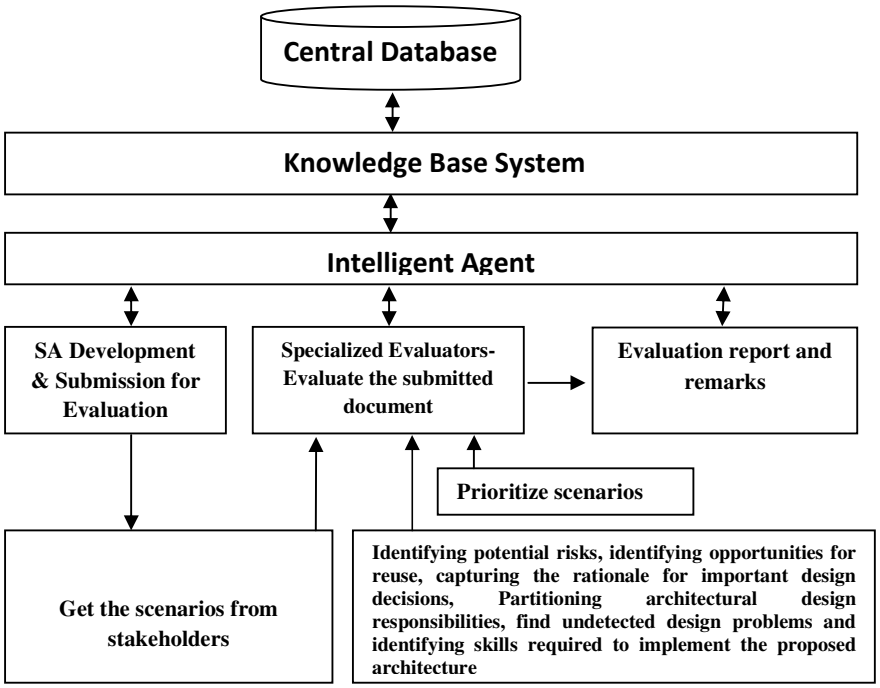

Figure 3: Framework for Software Architecture Evaluation

5. Implementation and Results

A study has been conducted to measure the effectiveness of SA Evaluation Framework in the software development of health care system, an Insurance unit and Banking system in a software company (India). By implementing this model for SA

evaluation, it is observed that the performance of the Framework for Software Architecture Evaluation systems has got the improvement in its outcome. The stakeholders, architect and the end user involved in the software development felt comfortable in using this Framework for Software Architecture Evaluation. All the data transaction in the SA Evaluation process is stored in the Central database which is very helpful to refer the required knowledge at anytime.

6. CONCLUSION

Software architecture is one of the most important and early decisions of the design process, with a strong influence on the final quality of the product. The two SA evaluation methods in existence were studied and the need of knowledge base in it is identified. A framework to enhance SA evaluation process is developed with the combination of knowledge base, intelligent agent and a central database. It has been tested with three units of software development and considerable improvement is obtained.

REFERENCES

1. Babar, M. A., DingsØyr, T., Lago, P., and van Viliet, H. (2009). Software Architecture Knowledge Management -Theory and Practice. Springer.

2. Babar, M., Kitchenham, B., Zhu, L., Gorton, I., and Jeffery, R. (2005). An empirical study of groupware support for distributed software architecture evaluation process. *Journal of Systems and Software*, 79(7):912-925.

3. Babar, M. A., Zhu, L., and Jeffery, R. (2004). A framework for classifying and comparing software architecture evaluation methods. *Australian Software Engineering Conference*, 0:309-318.

4. Babar, M. A. and Gorton, I. (2004). Comparison of Scenario-Based Software Architecture Evaluation Methods. APSEC'04, 600-607.

5. Bassey, M. (1999). Case Study Research in Educational Settings, Chapter 7: Methods of Enquiry and the Conduct of Case Study Research. *UK: Open University Press*, 65-91.

6. Cook, D. (2007). Architecture evaluation and review practices. http://msdn.microsoft.com/en-us/library/bb896741.aspx Accessed, February 2010

7. De Boer, R. C. , Farenhorst, R., Lago, P., van Vliet, V., Clerc, V., and Jansen, A. (2007). Architectural Knowledge: Getting to the Core, in Overhage, S. et al. (Eds.): QoSA 2007, LNCS 4880, pp. 197–214, Springer-Verlag Berlin Heidelberg.

8. Farenhorst, R., Lago, P., van Vliet, H. (2007). EAGLE: Effective tool support for sharing architectural knowledge. Int. J. Cooper. Inform. Syst. 16(3/4), pp. 413–437.

9. Ionita, M., Hammer, D., and Obbink, H. (2002). Scenario-based software architecture evaluation methods: an overview. In *Workshop on Methods and Techniques for Software Architecture Review and Assessment at the International Conference on Software Engineering*.

10. Kazman, R., Bass, L., Webb, M., and Abowd, G. (1994). Saam: a method for analyzing the properties of software architectures. In *ICSE '94: Proceedings of the 16th international conference on Software engineering*, pages 81-90, Los Alamitos, CA, USA. IEEE Computer Society Press.

11. M.Wooldridge and N.R.Jennings, Intelligent agents : Theory and practice. The knowledge engineering Review,10(2):115-152,1995

12. Sofia Sherman., Irit Hadar and Meira Levy (2010),"Enhancing Software Architecture Review Process via Knowledge Management" Proceedings of the sixteenth Americas conference on Information Systems.