Empirical Assessment in Software Architecture: Importance and Challenges

Muhammad Ali Babar[1], Patricia Lago[2,] Paris Avgeriou[3]
[1]Lero, University of Limerick, Ireland, [2]VU University Amsterdam, the Netherlands, [3]University of Groningen, the Netherlands

1. Motivation

Software engineering researchers and practitioners have been emphasizing the importance of gathering and disseminating empirical evidence to assess current research, identify the promising areas of research and to make informed decisions for selecting a suitable method, technique, or tool [1]. In recent years, Software Architecture (SA) community has developed many methods, techniques, and tools to support software architecture design, documentation, and evaluation activities. However, apart from a few exceptions, there has been little effort to gather and use empirical evidence to support the claims of efficacy or capabilities of different methods and techniques developed for supporting the software architecture process [2]. In order to improve this situation, there has been growing recognition of the importance of providing community-based forums to debate the importance of and challenges involved in comparative evaluation of technologies proposed to support software architecture activities using evidence-based approaches[1]. The evidence-based paradigm provides an objective and structured means of assembling and analysing the available data in order to answer research questions. Like the first EASA08 during WICSA 2008, the aim of the second EASA09 is to debate the importance, benefits, and limitations of rigorously assessing software architecture research outcomes by utilizing the methods and approaches from the evidence-based paradigm.

2. Workshop Objectives

The main objectives of the EASA09 are:

- Bring the attention of the software architecture community to the importance of rigorous assessment and/or comparative evaluation of software architecture technologies;
- Discuss the types of evidence required to support software architecture technology selection decisions;
- Identify and debate on appropriate methodologies and criteria for assessing software architecture research outcomes;
- Identify and debate the benefits and limitations of empirical approaches for assessing software architecture research and;
- Provide a platform to create a collaborative environment for researchers and practitioners interested in systematically gathering and widely disseminating evidence about the effectiveness and efficiency of architecture technologies.

3. Topics of Interest

We seek short papers and extended abstracts on all aspects of assessing and comparing software architecture technologies, including the following:

- Lessons learned from assessing software architecture technologies;
- Challenges and opportunities of doing empirical studies for assessing software architecture technologies;
- The pros and cons of guiding software architecture research through empirical studies;
- Comparative studies between different technologies of software architecture;
- Assessment frameworks for software architecture technologies;
- Measurement mechanics and metrics for assessing the quality of software architecture technologies;
- Estimation models - Validation of assessment techniques for software architecture design and evaluation;
- Assessment techniques, methods and tools for different activities of the software architecture design, description, and evaluation;
- Infrastructure issues, such as measurement theory, experimental design, qualitative modelling and analysis approaches.

4. Main Research Questions

The participants are expected to propose and debate several questions related to the assessment of software

[1] http://wwwp.dnsalias.org/wiki/Wicsa7:Workshop:Empirical_Assessment_in_Software_Architecture

architecture technologies. Some of the questions to be discussed are:

- How are the software architecture technologies evaluated?
- How should software architecture research outcomes be assessed to support technology transfer?
- What are the most appropriate mechanisms and methods to assess and compare software architecture deign and evaluation technologies (methods, techniques, and tools)?
- What is the role of empirical methods for software architecture research and practice?
- How to empirically assess the usability and usefulness of software architecture technologies (e.g., Architectural description languages) within industrial settings and considering cost bounds?
- How to support the quality assessment of software architecture technologies during the different phases of the software lifecycle?
- To what extend software architects and project managers should rely on existing software metrics and traditional quality indicators?

During the first EASA08, the participants also identified the following questions that were discussed by the participants in breakout groups:

- General issues
    - What type of evidence do we need - positive vs. negative evidence?
    - To what extents is SA empirical research different? Is it more qualitative? Is it more dependent on stakeholders? Does it need more historical data? What type of (historical and evolution) data do we need?
    - What (standard) set of metrics are needed?
    - What are the appropriate methodologies/criteria for assessing SA research outcomes?
    - How to convince decision makers in industry?
    - What are the benefits/limitations of empirical approaches for assessing SA research?
    - What kind of education and training do we miss for “empirical researchers”?
- Specific issues
    - Systematic reviews: what challenges? What domain knowledge needed to setup the protocol? What evidence do we need - quantitative or qualitative?
    - Industrial experiments: to what extents does tool support help architecting work? How to design such experiments?
    - How to define and measure effects of SA on requirements decisions? What are the (relevant) architectural 'aspects' to be studied?
    - What types of industrial projects and how to characterize them?
    - Can we identify standard characterization schemas for empirical SA assessments (e.g., SA changes)?
    - Can we aim at a reference model of data and metrics?

5. Workshop Format

The format of the workshop will strongly be discussion-oriented. It will combine invited talks, presentations, and focused group discussions. The presenters are expected to describe their thoughts, lessons learned, or points of view with respect to the mechanics, importance, and challenges of utilizing empirical methods for guiding and/or evaluating software architecture research and practice. Moreover, the presenters will also describe their experiences and/or novel ideas on how to assess software architecture research. The presentations are expected to generate issues that will stimulate the discussions during the workshop and help develop a preliminary agenda for conducting empirical research in software architecture discipline.

6. References

[1] Dyba, T., Kitchenham, B., and Jorgensen, M., Evidence-Based Software Engineering for Practitioners, *IEEE Software*, 2005. **22**(1): pp. 58-65.

[2] Falessi, D., Ali-Babar, M., Cantone, G., and Kruchten, P., Applying Empirical Software Engineering to Software Architecture: Challenges and Lessons Learned, *Tech Report* 09.78, University of Rome "Tor Vergata" Italy, 2009.