A Framework for Software Reference Architectures Analysis and Review

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Contents

I. Introduction & Industrial Context

II. Empirical Framework

III. Application of the Framework
   I. Survey for value-driven data
   II. Survey about impact of using an RA

IV. Conclusions & Future Work
INTRODUCTION & MOTIVATION
Architects vs. city planners

I. Introduction

II. Framework

III. Use of the Framework

IV. Conclusions

Reference Architectures Analysis
What is an Software Reference Architecture?

- an architecture that encompasses the knowledge about *how to design concrete architectures of systems* of a given domain
Context and Stakeholders

I. Introduction
II. Framework
III. Use of the Framework
IV. Conclusions

Reference Architectures Analysis
Action-Research at everis

- Everis, a multinational consulting firm based in Spain.
- Framework mainly originated throughout our involvement for helping everis
  - Other organizations with similar context as everis
Research problem

1) Is it worth to invest on the adoption of an RA?

2) Once adopted, how the suitability of an RA for deriving concrete SAs for an organization’s applications can be ensured?

Lack of support for practitioners (e.g., guidelines about how to gather data)!!
GOAL:
To devise a framework that, by means of empirical studies, supports organizations to:
1) Assess if it is worth to adopt an RA
2) Ensure suitability of an RA
What and How to Analyze Reference Architectures?

FRAMEWORK
### What to review?

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description of the Architectural Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Overview</strong>: functionalities, origin, utility and adaptation [Angelov et al. 2008] [Galster et al. 2011]</td>
</tr>
<tr>
<td>2</td>
<td><strong>Requirements analysis ➔ quality attributes</strong> [Falessi et al. 2010] [Angelov et al. 2008] [Gallaguer 2000]</td>
</tr>
<tr>
<td>3</td>
<td><strong>Architectural knowledge and decisions</strong> [Falessi et al. 2010] [Gallaguer 2000] [Nakagawa et al. 2011]</td>
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<tr>
<td>4</td>
<td><strong>Business qualities and architecture competence</strong> [Angelov et al. 2008] [Bass et al. 2008]</td>
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<tr>
<td>5</td>
<td><strong>Software development methodology</strong> [Falessi et al. 2010] [Nakagawa et al. 2011]</td>
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<tr>
<td>6</td>
<td><strong>Technologies and tools</strong> [Falessi et al. 2010] [Nakagawa et al. 2011]</td>
</tr>
<tr>
<td>7</td>
<td><strong>Benefits and costs metrics to derive SAs from Ras</strong> [Falessi et al. 2010]</td>
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</table>

Qualitative

Quantitative
Empirical studies of the Framework

I. Introduction
II. Framework
III. Use of the Framework
IV. Conclusions

Step 1: Understand
Survey to check existing value-driven data in organizations
- Existing data that organizations have to quantitatively calculate the costs and benefits of adopting an RA in an organization.

Step 2: Evaluate
Economic model to calculate the ROI of adopting an RA
- What is the value of an RA? (quantitative)

Once adopted, how can we ensure the suitability of an RA for deriving concrete SAs for an organization’s applications?

Survey to understand the impact of using an RA
- Evidence about RA practices and RA impact on the organization.
- Refined review criteria for RA.
- Context of the organization.

Architectural evaluation method specific for RA
- How well an RA supports key aspects? (qualitative)
APPLICATION: SURVEY FOR VALUE-DRIVEN DATA IN PROJECTS
Survey value-driven data (1/4)

I. Introduction

II. Framework

III. Use of the Framework

IV. Conclusions

Objective

- To discover existing data that organizations have to quantitatively calculate the costs and benefits of adopting an RA in an organization.
- Comparing economics (cost & benefits) of creating applications: ad-hoc vs. based on RA.

Participants & Sampling

- Software Architect
- Application builder

Empirical Study

- Exploratory surveys with personalized questionnaires applied to relevant stakeholders (e.g., manager, architect, developer) to find out the data that has been collected in projects.

Approach

- Online questionnaires

Reference Architectures Analysis
Survey value-driven data (2/4)

• Effort metrics to calculate projects’ costs
Sw. metrics to calculate benefits (e.g., reuse)
Survey value-driven data (4/4)

- Software development is a low-validity environment
  → Need to move to a high-validity environment.
  - Time tracking
  - Continuous feedback
  - Test-driven development

APPLICATION: SURVEY ABOUT IMPACT OF USING AN RA
<table>
<thead>
<tr>
<th>Objective</th>
<th>To understand the impact and suitability of an RA for the creation of SAs of software systems.</th>
</tr>
</thead>
</table>
| Participants & Sampling | Software Architect  
| | Architecture developer  
| | Application builder |
| Empirical Study | Exploratory surveys with personalized questionnaires applied to relevant stakeholders (e.g., manager, architect, developer) to gather their perceptions and needs. |
| Approach | Semi-structure interviews  
| | Online questionnaires |
Benefits

- (Ben1) Reduction of the development time and faster delivery of applications
- (Ben2) Increased productivity of applications builders
- (Ben3) Cost savings in the maintenance of applications
- (Ben4) Increased quality of the enterprise applications

Number of Responses from Software Architects
Survey about RA impact (3/4)

- **Drawbacks**
  - (Dra1) Additional **learning curve**
  - (Dra2) **Dependency** on the RA
  - (Dra3) **Limited flexibility** of the application

![Number of Responses from Software Architects](image)
Survey about RA impact (4/4)

• Lessons Learned
  ▪ Split questions that deal with more than one variable.
  ▪ Design questionnaires having into account participant knowledge and interest
  ▪ Online questionnaires:
    • n/a option
    • Back button
  ▪ Interest of participants from everis
CONCLUSIONS & FUTURE WORK
Conclusions

- We present a framework to conduct empirical studies for assessing RAs
  - Relevant aspects for RAs assessment, and an assortment of four complementary empirical studies
  - The framework can be adapted to the specific context of ITCFs

- Main results:
  - Importance of time tracking
  - RA could bring cost savings in applications
Future Work

- In terms of validation, we are conducting the Everis case using our framework, getting feedback for assessing its effectiveness.

- We aim to extend it considering Wohlin’s improvement step in order to build preliminary guidelines for improving RAs in ITCFs.
Thank you!!
Comments and Questions

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