Chapter 11
Phase 8: Software Architecture Alternatives Evaluation

Abstract In order to investigate whether a candidate architecture is suitable to achieve its functional as well as quality requirements, candidate architectures have to be evaluated by applying a software architecture evaluation method. This chapter provides a structured overview of existing architecture evaluation methods. We review the secondary literature in a systematic way in order to gather the state-of-the-art in the area of software architecture evaluation methods. Then, we select one method according to the defined selection criteria. The selected architecture evaluation method is used for evaluating the resulting architecture alternatives using the QuaDRA framework from the previous chapter.

11.1 Introduction

To choose an appropriate candidate architecture which achieves functional requirements as well as quality requirements with a particular level of satisfaction, the resulting candidate architectures have to be evaluated. Architecture evaluation aids to address the following concerns [169]:

- Understanding the software architecture
- Verifying that all requirements are addressed in the software architecture
- Making sure that the software will have the desired quality attributes
- Identifying problems with the software architecture

Architecture evaluation methods focus on evaluating a software architecture to determine if and where in the software architecture there might occur problems. The aim of architecture evaluation is not to provide scalar results, but qualitative
results. Precisely characterizing quality requirements in terms of measurements at an early stage of design is not useful as such parameters are often implementation dependent. The architecture evaluation analyzes if an architecture is suitable with respect to a set of quality requirements and problematic with respect to another set of requirements.

In this chapter, we aim at evaluating the derived architecture alternatives that we created using the QuaDRA framework. We first provide a structured overview of existing software architecture evaluation methods. We review the secondary literature in a systematic way in order to gather the state-of-the-art in the area of software architecture evaluation methods. Then, we select one evaluation method according to defined selection criteria.

It is crucial to perform the selection by means of a systematic approach considering all relevant criteria. Hence, we develop a structured framework by means of the defined selection criteria. The framework draws upon various sources for accurate selection of the components, elements, and evaluation questions \[136, 88, 35, 34, 173\]. Our framework aids in deciding which architecture evaluation method is best suited for evaluating the derived architecture alternatives. The selected method is then applied for evaluation and identification of the problematic concerns in the created architecture alternatives.

The remainder of this chapter is organized as follows. We provide an overview of the state-of-the-art in the context of software architecture evaluation methods in Section 11.2. Section 11.3 provides a framework for selecting an appropriate software architecture evaluation method while in Section 11.4 we select the most suitable evaluation method using the developed framework. We evaluate software architecture alternatives using the selected method in Section 11.5. Section 11.6 presents related work and Section 11.7 concludes this chapter and summarizes its contributions.

### 11.2 Identification of Software Architecture Evaluation Methods

In this section, we aim at finding the state-of-the-art methods with regard to architecture evaluation. To this end, we define the following research question:

"Which methods are reported for evaluating architectures?"

To respond to this question, we searched secondary studies such as surveys, reviews, and mapping studies. Our objective was to find out whether there exists already a systematic review that provides an extensive overview of existing