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Studies on Software Architectural Design

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Abstract

In this paper, we discuss software architectural design methods, especially that in the early phase of software development to find out the design direction for the software.

In architectural design, we examine fundamental software structure considering the requirements on potential software that will be developed on the architecture, in terms of functionalities and quality attributes. Besides, as architecture imposes constraints on following software design, we have to determine the most appropriate design direction, in the early phase, based on information in hand at that time. In this paper, we examine an architectural design method, considering these characteristics.

We make a case study on actual architectural design to clarify that we need to examine the followings in architectural design; the applicability of architectural design alternatives to requirements, relative preferences among applicable candidates, and, in product-line architectural design, the tradeoffs between the appropriateness of architectural candidates to the product-line as a whole and the appropriateness to each member of the product-line. Then we develop the conceptual framework on architectural design, in which we clarify the relationship among various concepts related to software architecture and architectural design.

Based on the above observations, we propose a concrete architectural design method. This method provides the method to analyze requirements utilizing factors that determine quality attributes, separate requirements based on aspect-oriented concepts, categorize requirements for applicability examination, determine preferences using decision-making techniques, and examine tradeoffs for product-line architectural design. We evaluate the techniques based on an actual case of architectural design.

The contributions of the paper are to clarify the conceptual framework of architectural design, and to propose a concrete architectural design method based on it. Furthermore, as the method explicitly handles the criteria, reasons, and the result of design decision, it makes design objective, and helps us to trace the reasoning of the design decision.

Key Words: software architecture, architectural design, architecture evaluation, product-line architecture, product-line scoping