

The Tool for Design of Software Systems Architecture

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Abstract – the improvement of the technologies of software design happens by introducing the formal methods, and tools, which implement these methods. The classification and communication functions of quality requirements are implemented in the represented information-software complex. The composition of alternative architectures and selection of the optimal one is proposed here as well. The software complex is functionally the Decision Support System (DSS) for architect.

Keywords – software systems architecture, optimization, repository, quality requirements, design automation.

I. INTRODUCTION

High complexity of modern software systems and growing of requirements to their quality demand the modernization of the technologies of their design and development of tools for their fulfillment. Implementation of formal methods, such as math modeling, optimization, decision-making theory, allows to formalize following processes: requirements classification and communication, architecture design. The heuristic procedures based on the experience of designers are used most often to perform mentioned processes [1]. Obtained formalized models allow to develop tools for the automation of these processes [2], [3].

The project of tool for automated design of architecture of software systems on the base of Analytic Hierarchic Process is described in this paper.

II. THE STRUCTURE OF THE TOOL.

The general look of designed tool is shown on the Fig. 1.

Unit of requirements classification and selection of quality attributes.

The design of any software system always starts with selection of requirements to the system [6]. Authors propose to use the method developed them, and created on its base software complex described in [1]. In order to use standardized quality indices of designed system their classification is carried out in terms of the model of quality. The customer gives the initial requirements what is shown on the Fig.1. After entering customer requirements to the system the automated tool of architecture of software system design presents these requirements in standardized form on the base of international standards of quality ISO 25010. Standardized in such way user requirements are supposed to be requirements of quality in use. Values of indices of quality in use give values of indices of product quality according to the standard ISO 25010, and they in turn contain the list of indices of architecture quality. Transfer to the indices of quality of architecture is possible as well directly on the base of indices of quality in use by applying requirements

communication between quality in use indices and indices of architecture quality by means of QFD method what has been described in [1].

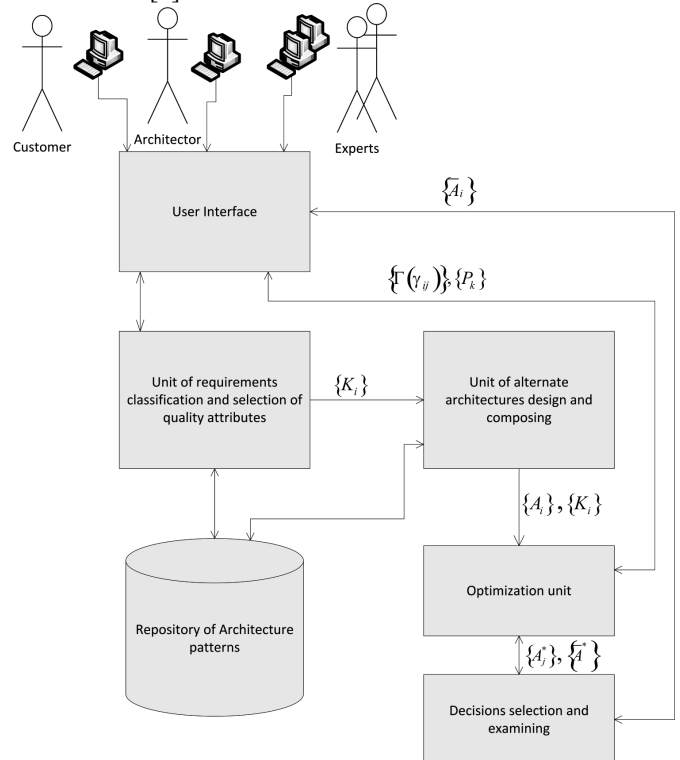


Fig. 1. The structure of the tool for design of architecture of software systems.

Unit of alternate architectures design and composing.

The next step of software design is composing of alternate architectures. The repository of architecture patterns is used to do this. Due to multilevel representation of architecture is accepted the repository has hierarchical structure. The categories of patterns are defined for every level and they are stored as classes diagrams and their descriptions with comparative attributes of quality within the category [4]. The selection and composition of alternative sample is going on according to the following algorithm. The type of application is defined in accordance to the functional requirements and the frame in form of layers is selected [4, 5]. For every layer of the frame the categories of patterns are defined and suitable patterns are selected from the repository. Composed architectures are transferred to the optimization unit.

Optimization unit.

The problem of selection of optimum architecture is stated as problem of multicriteria hierarchical optimization [2], [3].

The modified Analytical Hierarchic Method is used to solve this problem. The analysis and advantages of this method are given in [3].

Selected alternative architectures in form of classes diagrams and descriptive part as unified templates are inputted in the optimization unit. Optimization problem solution is going on in interactive mode with participation of experts. Experts fill matrices of pairwise comparisons of architectures for each quality attribute. Obtained solution of optimization problem as sequence of alternate architectures ranged in order of decreasing of weight indices values is analyzed by experts and matrices of pairwise comparisons can be adjusted by them.

Unit of decisions selection and examining.

Execution of all operations for forming of requirements, selection of quality attributes of alternate architectures, and selection of final decision happens in interactive mode with an architect. So specialized interface of the architect and experts is created.

The participation of experts who form matrices of pairwise comparisons is necessary for realization of Analytical Hierarchic Process. So workstations and interface for experts are provided. Sets of alternate architectures obtained as result of application of optimization procedure, ranged for every criteria of quality and for their totality, are analyzed by experts for trade-offs detections if conflicts are available.

Experts state priority coefficients for each criterion for determination of the best architecture on totality of criteria. After analysis of obtained solution experts can adjust criteria priorities [3].

Finally the customer and the architect obtain on output recommended architecture $\{\bar{A}_i\}$ that can be the base for further system design.

This plan reflects general principles described above of activity of automated systems of software architecture design.

Some units, such as unit of requirements classification and selection of quality attributes and optimization of architecture decisions unit have done, but some other units are in the stage of design and debugging.

CONCLUSION.

Represented tool can be used as working place of an architect of software systems. Its implementation can considerably improve effectiveness and quality of architect work by processes automation such as requirements classification, the selection and composing of alternative architectures, solutions optimization. Application of repository of patterns and search algorithms decrease the volume of work of architect because every category of patterns can contain dozens of instances [5] and comparative analysis of them can take a lot of time.

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