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A method for defining IEEE Std 1471 viewpoints

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Abstract

With the growing impact of information technology the proper understanding of IT-architecture designs is becoming ever more important. Much debate has been going on about how to describe them. In 2000, the IEEE Std 1471 proposed a model of an architecture description and its context.

In this paper we propose a lightweight method for modeling architectural information after (part of) the conceptual model of IEEE Std 1471 and defining IEEE Std 1471 viewpoints. The method gives support by outlining in textual form and in diagram form the relation of the concerns of the stakeholders to the architectural information. The definition of viewpoints can then be done with insight from these relations. The method has four steps: (1) creating stakeholder profiles, (2) summarizing internal design documentation, (3) relating the summary to the concerns of the stakeholders, and (4) defining viewpoints.

We have conducted a round of discussion and testing in practice in various settings. In this paper we present the feedback we received and propose improvements.

Keywords: Architecture; IEEE Std 1471; Viewpoints

1. Introduction

IT architecture is a relatively new branch within software engineering. IEEE Std 1471 (IEEE, 2000) defines it as "Architecture is the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution". van Vliet (2000) places the architecture definition phase in the software life cycle between the requirements engineering and design phases. In this phase the interests and concerns of all stakeholders are taken into account to come to a well-balanced solution.

Current practice is that designers of IT architectures are predominantly problem-driven. Design often is a fuzzy and non-rational process, see Parnas and Clements (1986), but after arriving at a balanced solution which solves the problem, the architect describes the solution in a structured way. This can be a one-time structuring or a structure following a known framework such as those of Kruchten (1995); Soni et al. (1995), or Boar (1998). Clements et al. (2003) offers many helpful models and guidelines for composing an architecture description. Using a one document framework for all stakeholders can mean for a certain stakeholder that the information that is relevant to his concerns can be very scattered, see Koning and van Vliet (submitted for publication).

In 2000, the IEEE Std 1471 proposed a model of an architecture description and its context. It offers a high level generic model for architecture descriptions with explicit attention to the concerns of the stakeholders.

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In this paper we offer support for the application of this model.

The organization of this paper is as follows: in Section 2 we lay out the research setting. In Section 3 we give a description of the method and show examples of the deliverables of each step. In Section 4 we outline the validation activities and present the results for each step. In Section 5 we draw our conclusions and propose improvements. Section 6 summarizes future work.

2. Research setting

In this section we lay out the research setting. We first introduce IEEE Std 1471 and state our position towards this standard. We then describe our project approach. We close this section with listing some assumptions on which our method is based.

2.1. IEEE Std 1471

IEEE Std 1471 describes a model of an architecture description (AD) and its context (IEEE, 2000). On page 1, it says: "The purpose of this recommended practice is to facilitate the expression and communication of architectures". On page 2: "Furthermore, it establishes a conceptual framework of concepts and terms of reference within which future developments in system architectural technology can be deployed. This recommended practice codifies those elements on which there is consensus; specifically, the use of multiple views, reusable specifications for models within views, and the relation of architecture to system context."

Central 'terms of reference' in the IEEE 1471 conceptual model are 'views', 'viewpoints', 'stakeholders' and 'concerns'. An 'architectural description' consists of 'views' that are each made according to a 'viewpoint' (see Fig. 1). According to the conceptual model a stakeholder is represented by his concerns.

A view is "A representation of a whole system from the perspective of a related set of concerns" (id, p. 9), and a viewpoint is "A specification of the conventions for constructing and using a view. A pattern or template from which to develop individual views by establishing the purposes and audience for a view and the techniques for its creation and analysis." (id, p. 10). Viewpoints delineate the architectural information that is presented to the stakeholder. A viewpoint on the one hand prescribes the content and 'models' to be used, and, on the other hand, it indicates its intended 'stakeholders' and their 'concerns'.

The standard lists a number of essential stakeholders and concerns, and gives examples of the use of architecture description and of some viewpoints. The standard gives no general guidance for defining viewpoints. It only states that a viewpoint addresses a set of related concerns and that the viewpoints together should cover all the concerns of the stakeholders. There are no criteria given to decide on the 'relatedness' of concerns.

With respect to our interest in communication of architecture, the main contribution of IEEE 1471 is the explicit orientation on stakeholders and concerns. Following the path from his recognized concerns via the prescriptions in the viewpoint a stakeholder should be able to find the information of his interest in the views.

We also believe there are some drawbacks to this standard, see Koning and van Vliet (submitted for publication). We feel IEEE Std 1471 should be extended with guidance on how to achieve document qualities like "accessibility" to and "understandability" for the stakeholders.

Our research focuses on the definition of viewpoints as the leverage point to improve the quality of the architecture description, and more particular on improving the insight in the relation of the architecture design to the concerns of the stakeholders, before deciding on the viewpoints to use.

Application of this method contributes to meeting clauses 5.2 and 5.3 of IEEE 1471. It can also be used to construct library viewpoints or evaluate existing library viewpoints for possible use in a given situation.

2.2. Project approach

This research project follows an "action research" approach, see Baskerville (1999). In action research five steps are defined: diagnosing, action planning, action taking, evaluation, specifying learning. Our diagnosing of four real life IT-architecture documents has raised serious doubts about whether the stakeholders could find the information they needed. Our action planning resulted in the method for designing IEEE 1471 viewpoints described in this paper. Our action taking has been discussion and small scale testing.

The action research participants were IT architects of two companies, ING and Ordina, and students from our faculty. ING is a Dutch international bank that attaches great importance to IT architecture to manage its very complex IT operations. Over 10,000 people are working in their IT departments worldwide, among them several hundred IT architects. Ordina is an IT-consulting firm. It has been developing a view on managing and documenting large IT processing environments for some years. Ordina Public Consulting has government and municipal organizations as customers. The students were taking part in a course on software architecture.

We were actively involved in the discussions and test sessions described in this paper as presenters and moderators. Notes were taken during all the sessions and shared with the persons present on the spot.