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Towards the Harmonization of Process and Product Oriented Software Quality Approaches

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Abstract. Software organizations are currently required to implement more than one software process improvement model concurrently. Several multimodel initiatives have appeared to support this situation, and existing proposals address integration from the process perspective, considering models such as CMMI, ISO 90003, ISO/IEC 12207, and ISO/IEC 15504. These efforts attempt to understand how to integrate process focused models in order to optimize resources and obtain the expected benefits. However, as the eventual aim of process improvement is to improve software product quality, it is also important to consider product quality models in harmonization efforts. In this paper, the result of mapping models based on both, (process and product) quality perspectives, is presented. The method used is also briefly described and applied to map ISO/IEC 25010 onto CMMI-DEV and ISO/IEC 12207. The result shows that process oriented improvement models consider product quality characteristics during the early stages of the software development life cycle, and that process improvement initiatives can therefore be driven by product quality improvement goals.

Keywords: product oriented quality approach, process oriented quality approach, harmonization, mapping, CMMI-DEV, ISO/IEC 12207, ISO/IEC 25010.

1 Introduction

Software organizations must confront diverse challenges if software products are to be developed efficiently. Market pressures, customers' needs, government regulations, and certifications are business drivers that organizations should consider when adopting quality standards, reference models, guidelines, or recommended practices [1]. Each improvement model has its particular goals, structure, granularity, and application domain. Software organizations must therefore deal with different improvement models simultaneously, and cope with the similarities and differences among them.

Various works addressing the multimodel problem [1, 2], i.e., when organizations use more than one quality approach simultaneously, have appeared. For instance, Pardo et al. [3, 4] propose a framework that provides the conceptual, methodological and technological support needed to facilitate the harmonization of multiple models. Harmonization is therefore an approach with which to integrate improvement models in order to achieve particular business objectives.

Harmonization initiatives have, to date, been focused on process oriented quality approaches. In the systematic review reported in [5], 60% of the primary studies selected (32 papers) analyze both reference models, such as ISO 9001, CMM, CMMI, and assessment models, such as ISO 15504 and SCAMPI. Kelemen et al. [2] analyze 78 papers, the majority of which deal with software process improvement (SPI) and quality approaches such as CMMI, SPICE, and ISO 9001. When models rely on the same quality approach, they may share vocabulary and structures that would ultimately assist in model integration.

Quality is a complex multidimensional concept that allows diverse research approaches [6] and software quality standards to be classified in two main categories: product and process [7]. However, few works have undertaken the integration of both process and product oriented perspectives from the viewpoint of harmonization.

A fundamental step in a harmonization strategy is how to compose the models [1, 2]. Model integration is usually carried out without coordination, and the organizational performance is overlooked when new technology is integrated. Quality approaches must be compared before a model can be composed. Various procedures with which to compare models as bilateral mappings or needs mappings exist [8], but low level comparison requires an understanding of both the structural differences of models, and the level of granularity, and this can make the comparison difficult [9].

In this paper we present the harmonization result of process and product quality models in order to support organizations when carrying out their process improvement programs driven by the desired product quality characteristics. A method with which to systematically carry out the mapping of models is also provided. This method has been applied in order to compare ISO/IEC 25010 [10] as a quality product software model with ISO/IEC 12207 [11] and CMMI-DEV [12], which are focused on the process perspective.

The remainder of this paper is structured as follows: Section 2 describes the works existing in literature that concern the integration of product and process quality perspectives. In Section 3 the method proposed to establish mapping in process and product oriented standards is presented. Section 4 describes how the method was applied to map ISO/IEC 25010 onto CMMI and ISO/IEC 12207; and finally, Section 5 shows our conclusions and future work.

2 Related Work

Few papers consider the alignment of process and product oriented quality approaches within an SPI effort. Therefore, there is insufficient evidence to establish causal relationships between the models used and the results obtained [13-15]. Balla et al.