A Qualitative Methodology for Tailoring SPE Activities in Embedded Platform Development

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Abstract. For real time embedded systems software performance is one of the most important quality attributes. Controlling and predicting the software performance in software is associated with a number of challenges. One of the challenges is to tailor the established and rather general performance activities to the needs and available opportunities of a specific organization. This study presents a qualitative methodology for tailoring process activities to a specific organization. The proposed methodology is used in case study performed in a large company that develops embedded platforms. A number of suggestions for modification and addition of process activities has been brought forward as a result of the study. The result can further be summarized as SPE in embedded platform development holds more opportunities for reuse, but also requires more focus on external stakeholders, continual training and coordination between projects.

1 Introduction

Software performance (i.e. response times, latency, throughput and workload) is in focus during the development and evolution of a variety of product categories. Examples of products are websites, network nodes, handheld devices, transaction systems, etc [1, 5, 15, 17, 21].

A number of software process activities have been proposed to help an organization with software performance engineering (SPE). Typical performance issues can include identifying performance bottlenecks, giving guidelines for functional partitioning, and help selecting the best alternatives of a number of design proposals. A normal challenge in introducing such process activities is to tailor the established and rather general performance activities to the needs and opportunities of the specific organization.

A product platform is per definition the basis of a variety of product versions. Each product version should be constructed with a low effort, compared to developing the complete platform [4, 13]. An embedded [10] platform is a specific type of product platform where a computer is built into the product platform and is not seen by the user as being a computer. Most real-time systems [3] are embedded products.

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For embedded platforms, specific possibilities and needs are present and should be considered in a process to support software performance work. Embedded platforms often have high-priority requirements on low cost. When this is the case, it is not possible to solve performance problems by, for example, increasing the hardware performance. A very long lead-time to change the hardware platform would be required, and it would also be expensive. During the development of an embedded platform, consideration of both the software design and hardware design must be taken. The design of the hardware architecture must be dimensioned based on the needs of the software applications that in many cases are yet to be implemented.

This study presents a qualitative methodology that can be used to tailor process activities to a specific organization. In the methodology, a conceptual framework containing software performance activities and software process activities is mapped to the needs and possibilities of the development within a case company. The case company develops real-time embedded platforms where software performance is one of the most important quality attributes of the product. The following research questions are investigated:

1. What restrictions or opportunities for a software performance engineering process are imposed by an embedded platform?
2. Does the presented methodology provide valuable input when tailoring an SPE process?

The paper is structured as follows. Section 2 introduces the qualitative methodology used, in Section 3 the methodology is applied to a specific company and in Section 4 the conclusions are presented.

2 Method

The research is carried out using a qualitative methodology [12, 20] designed to reveal which behaviors and perceptions that drive the studied organization towards a specific goal. This implies that the results of qualitative research are of a descriptive nature. Qualitative research is particularly useful for determining what is important to individuals and why it is important. In this context, qualitative research provides a process from which key research issues are identified and questions formulated by discovering what really matters to the organizations and why they matter.

The general method for qualitative studies [11, 14, 16] shown in Figure 1 is modified for tailoring software process activities to a particular area and company. One modification is the addition of the actual tailoring activity where new, changed and the deletion of activities can be proposed based on the pattern found. Also, a conceptual framework is introduced to set up the dimensions used during the pattern finding. The conceptual framework includes general process activities, development phases and stakeholders. These three different parts are initially populated by established and general knowledge of the particular process that is to be tailored. Performing an archive analysis in the studied