Case Study: Software Product Integration Practices

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Abstract. Organizations often encounter problems in the Product Integration process. The difficulties include finding errors at integration related to mismatch between the different components and problems in other parts of the system than the one that was changed. The question is if these problems can be decreased if the awareness of the integration process is increased in other activities. To get better understanding of this problem we have analyzed the integration process in two product development organizations. One of the organizations has two different groups with slightly different integration routines while the other is basing the development on well defined components. The obstacles found in product integration are highlighted and related to best practices as described in the interim standard EIA-731.1. Our conclusion from this study is that the current descriptions for best practices in product integration are available in standards and models, but are insufficiently used and can be supported by technology to be accepted and utilized by the product developers.

1 Introduction

Through investigations of many development organizations developing products with software as an important part, we have seen that the product integration is one of the processes where many of the problems in product development become visible. The origin of the problems is often in other processes performed early in the development cycle. These problems can be reduced through an increased understanding of the needs from an integration standpoint. Today, not enough care is taken to ensure that the system requirements are considered when components and parts developed. Proper preparation, understanding and performance of the product integration are believed to resolve part of this problem.

Integration of products that include software is described in several standards and collections of best practices. These best practices are collected from different companies and organization and include areas that are considered to be of good use for the development organizations in different application areas. There is however a lack of independent research which shows whether the practices described in these collections give the intended result when implemented in different organizations; a systematic validation of the practices is needed.

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There are different perspectives from which the use of descriptions found in standards and models can be investigated and different questions to be answered. The first question is how it can be determined that the processes described in the standards and models are suitable for different types of development and the use of different life cycle models; are the generic principles of the descriptions valid for all types of product development? Another question is if an organization may run into problems even if the principles and descriptions are followed in a proper way. Are there ways to fulfill the principles described but not achieve the intended results? A third question is how to determine if the reason for an organization having problems is the fact that the principles are described as the prescribed working method, but are still not followed. Our approach to these different perspectives is to look at the *performance* of the process in the investigated organizations and compare the activities with the ones prescribed in the standards and models regardless of the development model used. We also look at the problems in the organizations and analyze these with respect to the practices that are *not* followed by the organization.

We claim that we by investigating a number of organizations and the practices in use can obtain support for the practices described in standards and models *or* determine a need for revisions of the standards and models. This leads to the following research questions for this paper: (i) How well can the practices described in a specific standard be expected to reduce problems encountered in the integration of products? and (ii) What deficiencies or incompleteness can we observe in the proposed practice?

We have in this paper selected to use the interim standard EIA-731.1 [1] as the reference model. The rational for this is that the interim standard model has been used as one of the inputs to CMMI [2], and is specifically intended to be used for internal process improvement, not for qualification of suppliers. In addition to this, the development of this interim standard has been carried out in cooperation between a number of national and international organizations such as EIA[3] and INCOSE [4] involving a large number of organizations and companies with substantial experience in software and system product development.

Our proposition in this paper is that the problems encountered in the investigated units relate to the lack of execution of practices that are described in the interim standard. We also propose that successful execution of the product integration can be mapped to specific implementation of practices described in the interim standard.

This case study is a continuation of the work described in [5], where a different case has been compared to CMMI. The purpose of this paper is to investigate one additional source for best practices, compare it to current industrial problems and to establish if there are connections between the problems and the lack of execution of proposed activities.

The remainder of the paper is organized as follows. Section two describes general structure of the interim standard EIA-731.1 as well as the main characteristics of the integration processes of a development process. In section three, the case study design is described with explanations about the data collection method, the analysis method and the threats of validity of the study. Section four includes a description of the findings from the case study. Section five analyzes how the findings relate to best practices. Finally section six contains the conclusion and proposed future work and is followed by the references list.