Certifying Software Product and Processes

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INTRODUCTION

Software certification can not only greatly improve the overall quality of software; it can also help to control the cost of software development. Because software has traditionally been perceived as intangible, it has commonly been certified on the basis of the thoroughness of its development methodology. Certification of the development process is based on the assumption that the development process can assure that the developed product complies with specifications. However, software can also be certified at the product level. In this chapter, we will present a process model that captures the essential aspects of process and product certification (Silva, 2002).

BACKGROUND

Software can be certified at two levels: *process certification* and *product certification*. Process certification evaluates the process against a standard or model process to which it should conform. In Europe, the most popular process evaluation model is ISO9001 (Cianfrani, 2001). In America the focus of process quality improvement and evaluation is a process *maturity* model such as the Capability Maturity Model for Software (SW-CMM) and the Capability Maturity Model Integration (CMMI) (Chrissis, 2003; Humphrey, 1995; Paulk, 1993). Yet another example of process certification is Bootstrap from Europe (Card, 1993).

Product certification involves directly assessing the equivalence of key attributes of software at the level of its specifications (specified service), and its behaviour (actual service). A software product can be characterised by its functional and non-functional attributes. Examples of product certification include the Department of Defense Y2K certification process (DoD) and the Hong Kong Article Numbering Association Software Certification Program (Hong Kong Article, 1987).

CERTIFICATION MODELS

We first present two certification models, one for process certification and the other for product certification. We then present a generic certification model for both process and product certification. There are two key participants in the certification process, each playing a different role: the certification body and certificate applicant (or the software developer).

For the presentation of the certification process, we have adopted the IDEF0 notation (Klingler).

ProCess Certification (PCC)

Figure 1 shows the five major stages of the Process Certification (PCC) model.

PCC-0: Review of Certification Guidelines

The certification body studies the process requirements, analyses the relationships between the process requirements and the certification model, and identifies important requirements. It then issues and publishes the certification guidelines. An applicant will then study the certification model and process requirements and from that gathers important information about the implementation of the process. The applicant then includes the certification requirements in the production process before the process assessment.

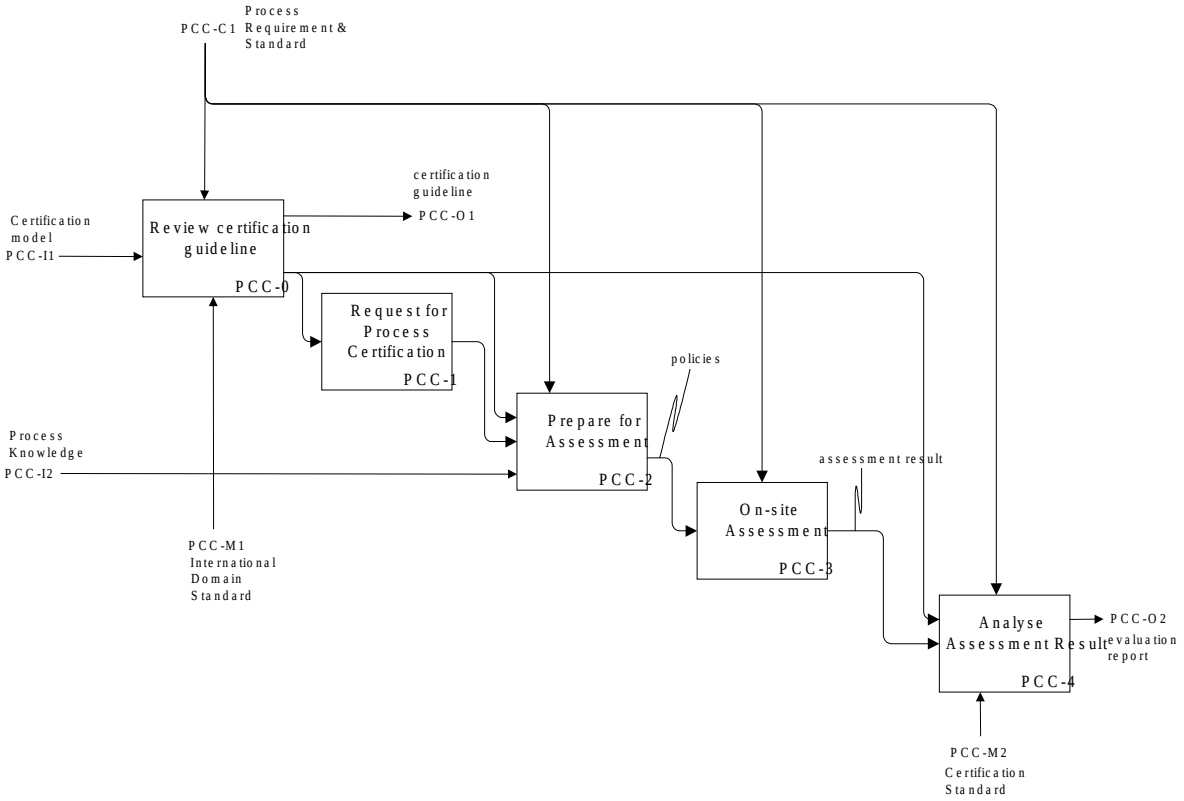
PCC-1: Request for Process Certification

After implementing the certification requirements in its production process, the applicant will apply to have the production process certified and will submit an application form to the certification body. The certification body will process the certification request and generate an application number to identify each certification.

PCC-2: Preparation for Assessment

The certification body will prepare the assessment guidelines and certification requirements to assess the applicant's production process. The body may familiarise the applicant's staff with the certification process by providing a pre-assessment service and audit training. The applicant's staff should ensure that the production processes fulfil the requirement of certification. The applicant then requests that the process be certified.

Figure 1. PCC model



PCC-3: On-Site Audit

The certification body will send assessors to the applicant's development site. Assessors will follow the assessment and certification guidelines to collect the process information and assess the applicant's production process. The applicant's staff should provide the necessary information to help assessors assess the production process. Finally, the assessors should produce an assessment report.

PCC-4: Analysis of Assessment Results

The certification body evaluates the assessment result to determine whether the production process passes the assessment and then returns the final result to the applicant. The applicant should analyse the assessment result to identify areas for improvement. Generally, to ensure that it keeps pace with the environmental and technological changes, the certification body should evaluate its certification guidelines after each certification.

Left-hand columns of Table 1 summarize the process stages of the PCC model.

ProDuct Certification (PDC)

Like the PCC model, the ProDuct Certification (PDC) model also consists of five major stages. The right-hand columns of Table 1 summarise the process stages of the PDC model.

The PCC and the PDC models not only both have five stages, they are also very similar in other ways. Indeed, although they differ in some details, most of their procedures have the same purposes and provide similar functions. For example, PCC-0, PCC-1, and PCC-4 are similar to, respectively, PDC-0, PDC-1, and PDC-4. The key difference between these models is that PCC focuses on the software production process, while PDC focuses on the software product.

Other specific differences between the PCC and PDC models are as follows.