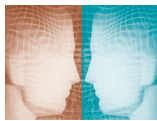


Software Certification Debate

Benefits of Certification

Leonard L. Tripp, Boeing



Certification will raise the benchmark for individual performance in achieving software quality and productivity.

The role of software in modern society continues to expand, raising user awareness of the importance of software-intensive systems, especially for safety-critical functions, and increasing user expectations for quality. Users expect software developers to meet certain standards of competence and ethics. That means software development is not done as code-and-fix programming or hacking—it is created according to principles of a software engineering profession.

RECOGNIZING A PROFESSION

How do we recognize a true profession of software engineering? In a 1996 report titled “A Mature Profession of Engineering,” Gary Ford and Norman E. Gibbs (<http://www.sei.cmu.edu/publications/documents/96.reports/96.tr.004.html>)

observed that professionals in other fields follow a professional-development path that is fairly similar, regardless of their specific discipline. For mature professions, this path includes initial professional education, accreditation, skills development, certification, licensing, professional development, professional societies, and a code of ethics.

I would add one additional item—professional standards. The variation in software engineering quality is due in large part to the lack of awareness of accepted best practices. The existence of standards is fundamental to the development of an engineering discipline.

For the past few years, the IEEE Computer Society has focused volunteer efforts on initiatives to support a true profession of software engineering. Under its “Doing Software Right” program and other joint activities with the ACM, the Computer Society has moved forward with curriculum development, professional training, a body of knowledge, a code of ethics, and standards.

The current (1999) IEEE software engineering standards collection (<http://standards.ieee.org/software/>) contains more than 40 standards totaling 2,400 pages in four volumes. The purpose of these standards is to

provide a vocabulary for communication between participants in the software engineering process,

- provide objective criteria for understanding claims regarding a product’s nature,

Computer’s editorial board thought that our readership would be well served by a discussion of the IEEE Computer Society’s new Certified Software Development Professional (CSDP) credential program. Thus, we invited Leonard Tripp, chair of the Computer Society’s Professional Practices Committee, to describe the program and outline its benefits to professional software developers. We also invited Adam Kolawa, CEO and president of Parasoft, a leading developer of software test tools, to set forth his concerns about the efficacy of certification. We welcome your comments.

*James H. Aylor
Editor in Chief*

Employers may view certification as a means for improving job performance and rewarding employees.

- provide methods for specifying product characteristics, and
- assure that quality assurance practices were applied.

But while standards have been established, they must be more widely disseminated and applied to individual practice to improve software quality and to advance the profession. That's where certification can play an important role.

Improving the discipline

Certification is a means for improving the discipline by promoting the practical implementation of standards, the awareness of a body of knowledge, the recognition of a code of ethics, and the need for professional development.

A certification program draws from each of these areas to establish a comprehensive competency benchmark for the profession. It identifies and establishes norms of common practice for the definition, design, and implementation of software. Certification benefits the software engineering profession by supporting minimum competency standards; encouraging use of disciplined software practices; and building awareness of best requirements, design, development, and test practices.

Establishing benchmarks

Knowledge and skills taught in school can be outdated quickly without continuing software engineering education. Certification exam preparation offers an opportunity for prospective certification candidates to refresh their understanding of technical areas. For some, certification exam preparation provides an introduction to new technical references and industry standards. A certification program can also provide a mechanism for lifelong learning for software practitioners. Certification programs usually include recertification requirements, either through additional continuing education credits or by retaking the exam. Thus, certification provides a method for ensuring that individuals continue to update their skills.

While establishing a competency benchmark benefits the profession, it also benefits the public at large. Certification provides a tool for measuring knowledge and skills so that the public can understand an individual's knowledge and competence in relation to others having a similar background. Certification is a standardized benchmark—the same requirements apply to all. The process identifies individuals with acceptable knowledge of

principles and practices of the profession. It also serves to advance public education about software engineering theory and practice.

CERTIFICATION CONSENSUS

There appears to be a consensus in the community about the importance of certification. In a 2001 IEEE Computer Society survey of software engineering professionals, more than 70 percent of the respondents agreed that certification would fill a need for improving the software engineering profession and that a software engineering certification program could be used to improve the engineering workforce. More than 67 percent agreed that certification helps assess an individual's software engineering knowledge and skills.

While the role of certification is primarily for the public benefit, individual practitioners may also benefit. The participants in this survey were given a list of eight possible benefits of certification and asked to pick up to three that would best describe the benefits to an individual software engineering practitioner. More than 80 percent of respondents felt that certification provides recognized evidence of professional capability. Two-thirds felt that certification helps assess an individual's software engineering knowledge and skills, while 44 percent felt that it leads to greater professional recognition.

Individuals may also seek certification for personal benefits such as increased opportunity for upward mobility, better ability to compete in the job market, and increased professional credibility, although these benefits were much lower rated by respondents.

In the same survey, respondents identified the benefits of certification to an employer hiring a practitioner. The highest ranking was given to the statement that certification provides confidence in a standard set of knowledge areas with which the individual will be familiar. Employers may also view certification as a means for improving job performance and rewarding employees. In difficult economic times, certification may survive company budget cuts. Employers may also find that training certified employees takes less time. Businesses may use the exam as a means to identify technical hierarchies.

CSDP CREDENTIAL

After a three-year development cycle, the Society recently launched its own certification examination—the Certified Software Development Professional credential—aimed at midlevel software engineers. The objectives of the CSDP program are to

- encourage self-assessment by offering guidelines for achievement,
- identify persons with acceptable knowledge of the principles and practices of software engineering,
- recognize those who have demonstrated a high level of competence in the profession,
- encourage continuing education, and
- raise standards of the profession for the public at large.

The CSDP is a comprehensive program that encourages individuals to draw from a broad base of software knowledge. The program is designed to measure the level of knowledge and competence that individuals have achieved in software engineering through *experience*, training, and education.

Because we believe that education alone cannot provide the knowledge and skills a midlevel engineer needs, candidates must have a minimum of experience within at least six of the 11 knowledge areas the examination covers. Candidates are also required to review the Software Engineering Code of Ethics and Professional Practices and acknowledge that they have done so. After 2003, some amount of training from the Computer Society, other IEEE entities, or professional training vendors will be mandatory for prospective candidates.

Recertification will require earning a certain number of continuing education credits during a three-year period. Individuals will also receive credit for volunteer activities such as peer review of technical papers.

Industry experts developed the CSDP under the direction of a leading test consultant, the Chauncey Group International. The Chauncey Group used well-established testing mechanisms to create an exam that is objective, job-related, and based on the knowledge and skills needed to function in the discipline. To accomplish this, the program's creators employed psychometric principles for validity and reliability during each step of the development process: job analysis, test specifications, item writing, item review, test assembly and review, pilot testing, cut score study, and item analysis. After each testing session, the developers will review the CSDP exam to substantiate its reliability and validity. Annual updates will keep the exam material relevant.

BUILDING ON PAST EFFORTS

We believe that the CSDP credential builds on the Computer Society's other efforts to promote

software engineering as a profession. It increases member interest in continuing education and raises awareness of the code of ethics. It also provides a vehicle to reward members who have developed a high level of professionalism. Finally, it encourages the orderly and efficient collection and consolidation of the body of knowledge.

In a technical world dominated by an array of vendor-specific certifications, we believe a professional society has an important role in creating a certification program focused on standards necessary to develop quality software. We also expect the program to initiate important discussions within the community.

The diversity of opinions about what makes up software development allows the exam to stand as a reference point for exchanges about what competency means.

We acknowledge CSDP both for what it is and what it is not. It is a professional certification program, but it is not licensure. The certification is voluntary, and it is not intended to create a barrier to entering the profession. Certification is not a guarantee of competency, but rather an assessment indicating that an individual understands a certain level of professional practice. CSDP is a credential of interest to many in the profession, particularly in safety- and mission-critical systems, but it is not for everyone.

Two factors in achieving success in the engineering of software are the organizational environment and the preparation of individuals participating in the software processes. The success of the Capability Maturity Model for Software since its introduction in 1987 has demonstrated that systematic organizational improvement is beneficial and that it can achieve significant quality and productivity benefits.

We are convinced that the CSDP certification program will contribute to significant improvement in preparing software development practitioners and will raise the benchmark for individual performance in achieving software quality and productivity. We believe the results will benefit both the profession and the public. ■

Leonard L. Tripp is a Technical Fellow at the Boeing Co., where he is involved in software engineering processes, standards, and certification. Tripp, the 1999 IEEE Computer Society president, is the chair of the Society's Professional Practices Committee. Contact him at leonard.l.tripp@boeing.com.

The CSDP measures the level of knowledge and competence that individuals have achieved in software engineering through *experience*, training, and education.