

A Summary of the ACM Position on
Software Engineering as a Licensed Engineering Profession

Final Version

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Executive Summary

ACM has been working with the IEEE Computer Society for several years on projects to examine and guide the evolution of software engineering as a profession. In recent years, the efforts of the joint Software Engineering Coordinating Committee (SWECC) have increasingly been perceived as furthering efforts to license software engineers. Two particular efforts stand out: 1) communications with the State of Texas relative to Texas' desire to develop a licensing exam for software engineers under the general framework for professional engineers (PE's); and 2) the development of a first-draft of a statement of the body of knowledge (SWEBOK) that all software engineers would be expected to know.

Concern over the direction that SWECC was moving prompted ACM to establish task forces to further investigate the issue of software engineering and the need for licensing. Following a study by a blue ribbon panel of prominent software engineers, the ACM Council decided in May 1999 that it could not support licensing of software engineers. ACM's position is that

Our state of knowledge and practice in software engineering is too immature to warrant licensing. Moreover, Council felt licensing would be ineffective in providing assurances about software quality and reliability.

At its meeting in May 2000, the Council further concluded that the framework of a licensed professional engineer, originally developed for civil engineers, does not match the professional industrial practice of software engineering. Such licensing practices would give false assurances of competence even if the body of knowledge were mature; and would preclude many of the most qualified software engineers from becoming licensed.

Because SWECC has become so closely identified with licensing of software engineers under a professional engineer model, the ACM Council decided to withdraw from SWECC.

Although ACM has withdrawn from SWECC, ACM believes the problem of reliable and dependable software, especially in critical applications, is the most important problem facing the IT profession. ACM will continue to work closely with IEEE Computer Society on projects that further the evolution of software engineering as a professional computing discipline and improve the quality of software and the capabilities of software engineers.

The Issue

For many years ACM has been involved in joint efforts with the IEEE Computer Society to examine ways to improve our ability to engineer software systems effectively. Most of the recent joint efforts have been directed toward creating a body of knowledge expected of competent software engineers. This body of knowledge also would likely provide the basis for an exam for licensing software engineers as professional engineers.

In the U.S., mandatory licensing has been used as a means to protect the public from malpractice by those offering services directly to the public, such as doctors, lawyers, civil engineers, contractors, day care workers, barbers, and surveyors. Many licensing advocates argue it would help promote software engineering into a profession and would safeguard society against incompetent engineers. Those against licensing argue it would not be practical-nor effective-in achieving these goals. Indeed, they say no recognized, generally accepted body of knowledge exists on which licensing examinations could be based.

Because of the importance and potential impact of this issue on ACM's constituency, ACM Council has been gathering information to help

determine whether the association Should be supporting efforts w closely linked with licensing. This report examines what we have learned and explains why the ACM Council has voted to withdraw from current joint ACM/IEEE-CS efforts that are being used to promote licensing of software engineers as Professional Engineers (PE)s It includes efforts to establish a body of knowledge that could be used as a basis for PE licensing examinations in software engineering.

Background

The Joint IEEE-CS and ACM Steering Committee for the Establishment of Software Engineering as a Profession was created in 1993. This committee was superseded in late 1998 by the Software Engineering Coordinating Committee (SWECC) which was established to act as a "permanent entity to foster the evolution of software engineering as a professional computing discipline."

SWECC, with the approval of the both societies, sets up projects in the general area of software engineering. It should be noted, however, that the SWECC Charter makes no mention of licensing. In fact, the ACM Council approved the Charter only because it appeared any effort to support licensing would be a small part of the SWECC efforts and would be done only in response to requests for professional advice and evaluation from licensing bodies. A key project of SWECC has been a software engineering body of knowledge-or SWEBOK-project, an outgrowth of a project begun by the Committee for the Establishment of Software Engineering as a Profession.

During the time SWECC was established, the ACM and IEEE-CS received a request by the Texas Professional Engineers Licensing Board for help in defining performance criteria for software engineering licensing exams to be administered in Texas. At the time, ACM agreed to establish the SWEBOK project under SWECC. One of the intended uses of the body of knowledge resulting from the project was as a source of information in response to the request from the Texas Board and other licensing agencies. This agreement was reached despite the fact some members of the ACM Council had strong reservations about whether licensing software engineers was in the best interests of the field of computing and the public.

In early 1999, ACM officers and Council members became concerned about the growing perception that the primary purpose of SWECC and its SWEBOK project was to support the licensing efforts of software engineers as PEs. To gather more information about the issue, ACM named an Advisory Panel on Professional Licensing in Software Engineering in March 1999 to make recommendations to the ACM Council about the role it should take with regard to licensing issues. The committee was headed by

Fran Allen and Paula Hawthorn and included as members Barry Boehm, Fred Brooks, Jim Browne, Dave Farber, Sue Graham, Jim Gray, Ken Kennedy, Nancy Leveson, Dave Nagel, Peter Neumann, Dave Parnas, and Bill Wulf. Although the panel could not reach consensus about licensing, the majority recommended against it and against supporting the Texas effort. (The final report of the Advisory Panel is included as an appendix to this report.)

After reviewing and discussing the advisory panel's report, the ACM Council passed the following motion in May 1999:

ACM is opposed to the licensing of software engineers at this time because ACM believes it is premature and would not be effective at addressing the problems of software quality and reliability.

ACM is, however, committed to solving the software quality problem by promoting R&D, by developing a core body of knowledge for software engineering, and by identifying standards of practice.

At that time, ACM decided to remain a member of SWECC. To determine how much support ACM should be providing to SWECC activities, ACM President Barbara Simons created two Blue Ribbon task forces in the summer of 1999. One task force would evaluate SWEBOK activities, the other would determine ways in which ACM and the profession might improve the robustness and quality of safety-critical software and evaluate the SWECC licensing activities in this context. (The report from the SWEBOK evaluation committee is included in the appendix. A preliminary report from the Safety-Critical Software committee covering the licensing and body of knowledge efforts is also included. Please noted this committee is still examining other ways commonly used to protect the public, including the use of standards and codes of practice, legal liability, codes of ethics, insurance and voluntary product certification, warranties, government regulation and oversight, definition of a standard curriculum, accreditation of educational programs, and independent inspection of safety-critical products. Their final report, detailing the findings and recommendations with respect to all of these possible safeguarding approaches, should be available by the end of the summer.)

ACM Position on Licensing of Software Engineers

After reviewing the two Blue Ribbon task force reports-in light of the growing perception that SWECC's primary efforts are in support of the licensing of software engineers as PEs-the ACM Council was convinced it was not appropriate for the association to continue as a member of SWECC. However, the Council also reaffirmed its support for some SWECC projects, such as the curriculum project and the ethics project, and

also reaffirmed its interest in cooperating with the IEEE-CS in efforts to foster the evolution of software engineering in order to improve the quality of software systems. The Council requested the ACM Executive Committee explore alternatives to SWECC for continuing these efforts, and then voted to withdraw from SWECC.

The motion passed by the ACM Council on June 30, 2000 states:

Society is becoming increasingly dependent on computers and software, which creates tremendous challenges and responsibilities for computing professionals. ACM Council believes that confronting these challenges will require creative and collaborative efforts by industry, universities, professional societies, and government. ACM Council strongly supports the idea of the ACM and the IEEE Computing Society working together on these challenges, including joint initiatives to promote the emergence of information technology professions.

However, ACM Council believes that the current efforts of the Software Engineering Coordinating Committee (SWECC) toward licensing is misguided as they assume that software engineering is a profession appropriate for licensing under the rubric of the Professional Engineers Licensing structure and requirements. Moreover, ACM Council feels that further efforts in this direction will detract from our ability to take other more practical and productive initiatives needed to meet our common goals.

Accordingly, Council directs that ACM withdraw from SWECC. Council further directs the Executive Committee to implement the decision to withdraw as quickly as possible.

To help ACM members understand the rationale behind this decision, we present the relevant findings and conclusions of the two task forces and then provide some questions and answers about the decision.

The Task Force on Licensing of Software Engineers Working on Safety-Critical Software, chaired by Nancy Leveson and John Knight concluded that:

Licensing as Professional Engineers would be impractical for software engineers, because it would require examinations over subjects most software engineers neither study in their formal education nor need in order to practice competent software engineering. Licensing software engineers as Professional Engineers would have no or little effect on the safety of the software produced.

The SWEBOK effort, which specifically excludes from the body of knowledge the special knowledge required for most safety-critical systems (such as real-time software engineering techniques), will have little relevance for safety-critical systems, and it dangerously excludes the most important knowledge required to build these systems. Each industry and software engineering domain will need to determine an appropriate mix of approaches that work together to solve their particular problems and fit within the cultural context of the particular industry. There are no simple and universal fixes to solve the problem of ensuring public safety. Effective approaches will involve establishing accountability, competency within specific application domains and job responsibilities, liability, regulation where appropriate, standards, voluntary product certification and warranties, and industry-specific requirements. Licensing as Professional Engineers would not be an effective way to accomplish any of these goals.

The task force recommended that:

ACM withdraw from efforts to license software engineers as Professional Engineers. ACM take a stand against government efforts to require the licensing of software engineers as impractical, ineffective with respect to protecting public safety, and potentially detrimental with respect to economic and other societal and technological factors. ACM not support the SWEBOK activities, but consider supporting other efforts to validate and codify basic knowledge in various aspects of software engineering. ACM investigate and support a broad range of approaches to solving any software quality issues that might exist.

The Task Force on Assessment of the Software Engineering Body of Knowledge Efforts, chaired by David Notkin, concluded that:

The selection process for including knowledge areas-which focuses on tables of contents of general software engineering textbooks and university curricula-is flawed and fails to recognize the gap between actual practice and what appears in textbooks. The SWEBOK effort-which uses "generally accepted knowledge" as the cornerstone for inclusion and specifically excludes "practices used only for specific types of software"-is highly likely to fail. The opposite approach-which focuses primarily focusing on specific domains-is far more likely to succeed. SWEBOK does not distinguish among possible roles within a software development project. A process for **updating the SWEBOK results based** on the actual

SWEBOK development efforts would be unlikely to succeed.

The task force recommended that:

The professional societies, including ACM, must pursue every possible means towards improving the current state of affairs. At the same time, they must refrain from pursuing activities like SWEBOK that have a significant chance of reducing the public's understanding of, confidence in, and assurances about key properties of software.

In the Appendix to this summary is a set of Questions and Answers to further explain, and expand on, the ACM position. The final version of this summary will include the reports of the Blue Ribbon Panel, the Body of Knowledge Task Force, and the Safety Critical Software Task Force.

Appendices

A.Q&A

Why is ACM withdrawing from SWECC?

The activities of SWECC have become associated with promoting the licensing of software engineers as Professional Engineers (PEs). Although many of the SWECC activities are still supported by ACM, such as the curriculum and ethics projects, having these projects remain under SWECC is not acceptable because by association they too are becoming viewed as support of the PE licensing mechanism for software engineers.

One of the central purposes of licensing is to provide assurances to the public that a licensed person is competent at their professional duties. In the case of software engineering, a license would be interpreted as an authoritative statement that the licensed engineer would be capable of producing software systems of consistent reliability, dependability, and usability. The ACM Council concluded that our state of knowledge and practice is too immature to give such assurances

Finally, the PE licensing mechanism is inappropriate for software engineering because its exam structure would preclude many of the most qualified software engineers from becoming licensed. ACM is opposed to any process that could prevent highly qualified software engineers, including many ACM members, from professional practice for which they are qualified..

Is ACM against licensing software engineers?

Yes. ACM is opposed to the licensing of software engineers because ACM believes that licensing would not be effective at providing assurances that software engineers could produce reliable, dependable, and usable software systems. When the body of knowledge matures and we have proven experience in certifying software engineering skills, ACM may reconsider its position.

Is ACM against software engineering being viewed as a profession?

No. ACM has a deep commitment to the professional ization of all parts of the IT field, not just software engineering. A field does not need licensing to be a profession.

In May 1999, the ACM Council launched a major initiative-the Information Technology Profession Initiative (ITPI)- to foster the emerging IT profession. The ACM appointed Past-President Peter Denning to chair the ITPI steering committee and direct the initiative.

Does ACM see a difference between licensing and certification?

Yes. Certification is a statement by a recognized authority that a person is competent in an area. Licensing is permission of a jurisdiction for someone to practice his/her profession in that locality. Often licensing relies on prior certification by professional societies. But a certificate is not a license and a license does not imply competence without appropriate certifications.

Under the ITPI, the ACM is exploring ways to offer professional certification to its members. Such a program is a long way from implementation. The ITPI steering committee believes if ACM, working cooperative with IEEE-CS and other groups, can establish a good certification program, that alone will be a major benefit to the profession.

Will ACM continue its efforts to improve the quality of software?

Absolutely. ACM believes the problem of reliable and dependable software, especially in critical applications, is the most important problem facing the IT profession. ACM Council is committed to improving the quality of software and the capabilities of software engineers through better education and promulgation of effective design strategies.

ACM is interested in working closely with IEEE-CS in fostering the evolution of software engineering as a professional computing

discipline. We hope that through ITPI, the SIGs, and other joint activities we can work together toward this important goal.

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