



*Introduction to Software  
Engineering Professional Issues*

SWENET OSE2 Module  
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## Overview

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- The Software Engineering Profession
- Professional Societies
- Certification, and Licensing
- Software Engineering Education & Training
- Ethics and Professional Conduct

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# The Software Engineering Profession

- Software engineering (SE) as a discipline and profession is relatively young, some even say “immature”.
- In 1996, Ford and Gibbs [6] listed designated eight infrastructure components that can be used to evaluate a mature profession:
  - a professional society
  - initial professional education
  - skills development
  - professional development
  - accreditation
  - certification
  - licensing
  - a code of ethics
- In the following slides, we will discuss these elements in relation to the current state of the software engineering profession.

# Professional Societies

- There is no professional society devoted exclusively to software engineering, but there are two societies which provide mature support for the software engineering profession:
  - Association for Computing Machinery (ACM) (<http://www.acm.org/>)
    - Founded in 1947, ACM has 75,000 members and has the objective of advancing the skills of computing professionals and students worldwide.
    - The ACM has 34 “special interest groups” (SIGS). The Special Interest Group on Software Engineering (SIGSOFT) focuses on issues relating to all aspects of software development and maintenance.
  - IEEE Computer Society (IEEE-CS) (<http://computer.org/>)
    - Founded in 1946, with nearly 100,000 members, it is the largest of the 36 societies of the Institute of Electrical and Electronics Engineers (IEEE).
    - The Computer Society's vision is to be the leading provider of technical information and services to the world's computing professionals

# Certification and Licensing - 1

- Certification is a voluntary process administered by a profession.
- Currently there are many certification programs for various computing technologies. Many are brand name certifications (e.g. Cisco, Java/Sun, Microsoft, Novell, etc.) and do not deal with the software engineering profession directly.
- The IEEE-CS offers a certification titled Certified Software Development Professional (CSDP) [7]. The CSDP has the following components:
  - At the time of application the candidate holds a baccalaureate or equivalent university degree and has a minimum of 9,000 hours of software engineering experience within at least six (6) of the eleven (11) SE knowledge areas (the ten SWEBOK areas [5] and Professionalism and Engineering Economics).
  - Candidates are required to subscribe to the *Software Engineering Code of Ethics and Professional Practice* [3]
  - Candidates must pass an exam demonstrating mastery of the knowledge areas

# Certification and Licensing - 2

- Licensing is a mandatory process administered by a governmental authority.
- In the U.S. licensing is administered at the state level.
- Only about 18% of U.S. engineers (civil, electrical, mechanical, etc.) are registered.
- Texas is currently the only state to license software engineers.
- In recent years, no topic has stirred more controversy and debate than certification and licensing of software engineers [4, 8].
  - This seems to signal that the nature and maturity of software engineering is not yet stable.

# SE Education & Training - 1

- Ford and Gibbs list four elements related to SE education: initial professional education, skills development, professional development and accreditation.
- Initial Professional Education
  - There are hundreds of computer programs (computer engineering, computer science, and information systems) in the U.S. that include significant material activities devoted to the software engineering education.
  - There over twenty undergraduate degree programs in software engineering in the U.S.
  - The ACM and the IEEE-CS have developed curriculum guidance for software engineering education [2, 7].
- Skills Development and Professional Development
  - Because of the dynamic nature of computing methods and technology, industry and government devote significant resources to the training of software engineers. Web searches for industrial training in software development demonstrates the magnitude of the skills development element.
  - The ACM and IEEE-CS promote and support professional development through publications, conferences, workshop and tutorials.

# SE Education & Training - 2

- Accreditation
  - The Accreditation Board for Engineering and Technology (ABET) has established accreditation criteria for software engineering programs.
  - The SE program specific criteria reads as follows:
    - The curriculum must provide both breadth and depth across the range of engineering and computer science topics implied by the title and objectives of the program.
    - The program must demonstrate that graduates have: the ability to analyze, design, verify, validate, implement, apply, and maintain software systems; the ability to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer science and supporting disciplines to complex software systems; and the ability to work in one or more significant application domains.
    - The program shall demonstrate that those faculty teaching core software engineering material have practical software engineering experience.

## Ethics and Professional Conduct

- Why should we be interested ethics and professional conduct?
- Here is one answer:
  - Today the quality of software produced by software engineers is critical to society.
    - The success of many, if not most, human endeavors is dependent on high-quality software (e.g. applications used in financial, legal, library, health, personnel, and transportation systems)
    - Lives depend on the safety and reliability of many software systems (e.g. control of aircraft, medical devices, and nuclear power stations)
  - In addition to technical capability, the quality of software products depend on the ethics and professional conduct of the engineers that developer develop them.

## SE Code of Ethics and Professional Practice

- Many professions (engineering, law, medicine) provide a code of conduct that defines and motivates professional and ethical behavior by its members.
- In 1999, an SE Code was developed by a ACM/IEEE-CS Task Force []
- The code addresses eight areas of concern. The following is short version of the SE Code:
  - PUBLIC - Software engineers shall act consistently with the public interest.
  - CLIENT AND EMPLOYER - Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest.
  - PRODUCT - Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.
  - JUDGMENT - Software engineers shall maintain integrity and independence in their professional judgment.
  - MANAGEMENT - Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.
  - PROFESSION - Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.
  - COLLEAGUES - Software engineers shall be fair to and supportive of their colleagues.
  - SELF - Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

# Conclusion

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- Software engineering is “maturing” profession.
- In the coming years the software engineering profession will have to deal with the issues of
  - providing appropriate initial and life-long professional education to its members
  - providing a framework to ensure that its members act in a professional and ethical manner

# References

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1. Accreditation Board for Engineering and Technology – home page (<http://www.abet.org/>)
2. Association of Computing Machinery – home page (<http://www.acm.org/>)
3. ACM/IEEE-CS Joint Task Force on Software Engineering Ethics and Professional Practices, *Software Engineering Code of Ethics and Professional Practice*, Version 5.2, (<http://www.acm.org/serving/se/code.htm>)
4. Boehm, B., et. al., Position Papers on Software Engineering & Licensing, ([http://www.acm.org/serving/se\\_policy/papers.html](http://www.acm.org/serving/se_policy/papers.html))
5. Bourque P. and R. Dupuis, eds. *Guide to the Software Engineering Body of Knowledge*, IEEE CS Press, Los Alamitos, CA., 2001. ([www.swebok.org](http://www.swebok.org))
6. Ford, Gary and Gibbs, Norman E., *A Mature Profession of Software Engineering*, CMU/SEI-96-TR-004, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, PA, 1996. ([http://www.sei.cmu.edu/pub/documents/96\\_reports/pdf/tr004\\_96.pdf](http://www.sei.cmu.edu/pub/documents/96_reports/pdf/tr004_96.pdf))
7. IEEE Computer Society - home page (<http://computer.org/>)
8. Knight, J., et. al., On Licensing Of Software Engineers Working On Safety-critical Software, Final Report of an ACM Task Force, August, 2001 ([http://www.acm.org/serving/se\\_policy/safety\\_critical.pdf](http://www.acm.org/serving/se_policy/safety_critical.pdf))
9. Mead, N., “Issues in Licensing and Certification of Software Engineers”, Software Engineering Institute, Carnegie Mellon University, March 2002 (<http://www.sei.cmu.edu/staff/nrm/license.html>)