The Maturation of Software Engineering as a Discipline and a Recognized Profession

Pierre Bourque, Ph.D.
École de technologie supérieure
Canada

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IEEE Computer Society

- Institute of Electrical and Electronics Engineers:
  - 360,000 members in 175 countries.
  - Publishes 30% of the world’s technical literature within its scope of interest.
- The Computer Society is the largest of IEEE’s 37 technical societies:
  - 100,000 members, 40% outside the US.
  - Founded in 1946, the world’s oldest and largest association of computing professionals.
Presentation Objectives

- What is a discipline?
- What are the components of a recognized profession?
- How does software engineering stand in regard to the components of a recognized profession?
- Is software engineering truly an engineering discipline?

Presentation Objectives

- How does software engineering relate to computer science, to computer engineering, to project management?
- Is licensing necessary to be a recognized profession?
- Give an overview of the Guide to the Software Engineering Body of Knowledge (SWEBOK)?
- Discuss the role of the SWEBOK Guide in regard to the maturation of software engineering as a discipline and a recognized profession?
What is Engineering?

- A traditional definition of engineering is:
  - “The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.”
  - (HMC 2000)

What is Engineering?

- A more encompassing view is:
  - “The application of a systematic, disciplined, quantifiable approach to structures, machines, products, systems or processes.”
  - (IEEE 1990)

- This view of engineering as being more than “applied science and mathematics” implies that an engineering discipline has a body of knowledge of its own which differs from the body of knowledge of its underlying scientific discipline.
What is Software Engineering?

- “(1) The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.”
- (2) The study of approaches as in (1).”
  - (IEEE 1990)

Computer science is the underlying discipline of software engineering

- Fundamental goals of computer science and software engineering differ:
  - Science as a whole seeks to better understand and explain various phenomena.
  - Artefacts are the product of engineering
- Ever-increasing depth and breadth of knowledge in computer science enables the establishment of software engineering as a discipline in itself
  - Occurred in the 18th and 19th century for most “traditional engineering disciplines”
- Differing and of course overlapping bodies of knowledge
What is a Discipline?

“**A branch of knowledge or teaching**”

(HMC 2000)

Recognized Profession?

- Knowledge and competence validated by the community of peers
- Consensually validated knowledge resting on rational and/or scientific grounds
- Judgment and advice oriented toward a set of substantive values

(Starr, 1982)
Development of a Profession

- Initial professional education
- Skills Development
- One or both: Certification, Licensing
- Accreditation
- Professional societies
- Professional development
- Code of ethics

Adapted from Steve McConnell, *After the Gold Rush*, Microsoft Press, 1999, p. 93
2004 Version

Project Objectives

- Characterize the contents of the Software Engineering Body of Knowledge
- Provide a topical access to the Software Engineering Body of Knowledge
- Promote a consistent view of software engineering worldwide
**Project Objectives**

- Clarify the place of, and set the boundary of, software engineering with respect to other disciplines (computer science, project management, computer engineering, mathematics, etc.)
- Provide a foundation for curriculum development and individual certification and licensing material

**Intended Audience**

- Public and private organizations
- Practicing software engineers
- Makers of public policy
- Professional societies
- Software engineering students
- Educators and trainers
Categories of Knowledge in the SWEBOK

| Specialized | Generally Accepted | Advanced and Research |

- North American Bachelor’s degree + 4 years of experience

Three Underlying Principles of the Project

- **Transparency**: the development process is itself published and fully documented
- **Consensus-building**: the development process is designed to build, over time, consensus in industry, among professional societies and standards-setting bodies and in academia
- Available **free** on the web
A Three-Phase Approach for Developing the Guide

- Straw Man Phase
- Stone Man Phase
- Iron Man Phase (Sub-phase 1)
- Iron Man Phase (Sub-phase 2)
- Trial Version
- 2004 Version

1998 1999 2000 2001 2002 2003

Formal resolutions

- Industrial Advisory Board (2001)
- IEEE CS Board of Governors (2001)
  - “The Board of Governors of the IEEE Computer Society accepts the Guide to the Software Engineering Body of Knowledge (Trial Version) as fulfilling its development requirements and is ready for field trials for a period of two years”
- IEEE CS Board of Governors (Feb. 2004)
  - Officially approved the 2004 Version
- Official recognition as ISO Technical Report 19759
Deliverables:

- **Consensus** on a list of Knowledge Areas
- **Consensus** on a list of topics and relevant reference materials for each Knowledge Area
- **Consensus** on a list of Related Disciplines

Knowledge Areas and Related Disciplines

- Software Requirements
- Software Design
- Software Construction
- Software Testing
- Software Maintenance
- Software Configuration Management
- Software Eng. Management
- Software Eng. Tools & Methods
- Software Engineering Process
- Software Quality

**Related Disciplines**

- Computer Engineering
- Computer Science
- Mathematics
- Project Management
- Management
- Quality Management
- Software Ergonomics
- Systems Engineering
Evolution of the SWEBOK Guide

- Next planned version is 2009
- Main focus of changes
  - Harmonization of IEEE software engineering professional products with the SWEBOK Guide as the cornerstone
Number of publications citing the SWEBOK Guide by publication type and by year of publication

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Number of Citations

- SWEBOK Guide is widely cited.
- Steady stream of citations over time.
- Citations of the SWEBOK Guide have appeared in the top journals of the discipline, including two citations in IEEE Computer, seven citations in IEEE Software, two citations in Information and Software Technology, and five citations in the Journal of Systems and Software.
- For papers appearing in 2005, these citations already include four citations in the Journal of Systems and Software and two citations in IEEE Software.
Number of Hits (As of 3 December 2007)

- books.google.com identifies over 124 books citing “SWEBOK”
- scholar.google.com identifies over 1330 hits for “SWEBOK”
- Google.com identifies over 85000 hits for “SWEBOK”
- IEEE Xplore has 178 citations of “SWEBOK”

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Two Selected and Recent Usage Examples

- ISO Software Engineering - Certification of Software Professionals
  - Establish a framework for comparison of schemes for certifying persons as software engineering professionals
  - Facilitate the comparison of national and international certification schemes of software engineering professionals
  - SWEBOK Guide is used as a baseline for comparison of bodies of knowledge in the certification schemes
  - Committee Draft - Should be a ISO standard within a year

Two Selected and Recent Usage Examples

- Graduate model curriculum
  - Ongoing project titled Integrated Software and Systems Engineering Curriculum (iSSEc) Project
  - Currently an initiative sponsored by the US Department of Defense
  - Primary source for the body of knowledge for software engineering is the SWEBOK Guide
Increasing maturity of Software Engineering

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Concluding Remarks

- Consensus on the core body of knowledge is key in all disciplines and pivotal for the evolution toward a professional status
References