The Emerging Consensus on the Software Engineering Body of Knowledge

A. Abran, P. Bourque, R. Dupuis, J. W. Moore, L. Tripp

CUSE
Montréal, 7 Mars, 2002

www.swebok.org
Corporate Support by:

Canadian Council of Professional Engineers
Conseil canadien des ingénieurs

Project managed by:

Université du Québec
École de technologie supérieure

www.swebok.org
Presentation Plan

- Project background
  - Project objectives, audiences and plan
  - Content of the Guide
  - Next steps
  - Research Issues
Key Issues

- **Groups and individuals:**
  - Different views of software engineering

- **Universities:**
  - Offering undergraduate degrees in *Software Engineering*, outside of traditional Engineering Departments
  - Limited consistency across curriculum
  - Different accreditation groups (Canada:CIPS and CCPE)

- Increased interest in the establishment of a profession
Market Trends - Examples

Texas Board of Engineers:

- Decision to license software engineers: a strategy with significant impact on:
  - industry (e.g. mobility of staff & training)
  - universities
  - policy bodies
  - individuals

(+ engineering boards in Canada and universities)
What is Software Engineering?

- IEEE 610.12:
  - “(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).”
Key Interrelationships for a Core Body of Knowledge

- Development of Software Engineering Curricula
- Consensus on a Core Body of Knowledge
- Development of Certification / Licensing Criteria and Exams
- Development of University Program Accreditation Criteria

Influences:
- Development of Software Engineering Curricula
- Consensus on a Core Body of Knowledge
- Development of University Program Accreditation Criteria
Presentation Plan

- Project background
- **Project objectives, audiences and plan**
  - Content of the Guide
  - Next steps
  - Research issues
Project Objectives

- Promote a consistent view of *software engineering* worldwide
- Clarify the place of, and set the boundary of, software engineering with respect to other disciplines
- Characterize the contents of the Software Engineering Body of Knowledge - SWEBOK
- Provide a topical access to the Software Engineering Body of Knowledge
- Provide a foundation for curriculum development and individual certification and licensing material
Intended Audiences

- Public and private organizations
- Practicing software engineers
- Makers of public policy
- Professional societies
- Software engineering students
- Educators and trainers
What Are we Not Trying to Accomplish?

- Not an all-inclusive description of the sum of knowledge in the field
- Not all categories of knowledge
- Not a curriculum development effort
Categories of Knowledge in the SWEBOK

<table>
<thead>
<tr>
<th>Specialized</th>
<th>Generally Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced and Research</td>
<td></td>
</tr>
</tbody>
</table>

Focus of the SWEBOK Guide
Generally Accepted

- «Applies to most projects, most of the time, and widespread consensus validates its value and effectiveness»
  - Project Management Institute

- Bachelor + 4 years of experience
IEEE and ACM strategies

- IEEE-CS:
  - initial focus on generally accepted
  - strategy with intermediate deliverables
  - contributions to the maturation and consensus building

- ACM:
  - opposition to licensing
    - withdrawal from joint efforts with IEEE-CS
    - concerns: limited to specialized knowledge
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
  - Consensus does not equal Unanimity!

- Available *free* on the web
A Three-Phase Approach for Developing the Guide to the SWEBOK

Straw Man Version

Stone Man Phase (Trial Version)

Iron Man Version (Sub-phase 1)

1998 1999 2000 2001 2002 2003
Project Team

- Editorial team
- Industrial Advisory Board
- Knowledge Area Specialists
- A very large international group of Reviewers
Editorial Team

- **Project “Champion”:**
  - Leonard Tripp, 1999 President, IEEE Computer Society

- **Executive Editors:**
  - Alain Abran, UQAM
  - James W. Moore, The MITRE Corp.

- **Editors:**
  - Pierre Bourque, UQAM
  - Robert Dupuis, UQAM
A Three-Phase Approach for Developing the Guide to the SWEBOK

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

Timeline:
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
Strawman: Process

- Undergrad. SE curricula
- Graduate Admission Criteria
- Graduate SE Curricula
- SE Textbooks
- Preliminary list of related disciplines
- Prel. list of SE Knowledge Areas
- ISO/IEC 12207

Body of SE Standards
- List of related disciplines
- Proposed SE Knowledge Areas
- Proposed related disciplines and SE KAs

Must be discussed in general SE textbooks
Must be specifically adapted to SE
Knowledge Area Specialists

- Bertolino, Istituto Elaborazione Informazione, CNR, Italy
- Bollinger, MITRE, USA, Martin & Gabrini, UQAM
- Carrington, Queensland University, Australia
- El Emam, National Research Council, Canada
- MacDonell, University of Otago, New-Zealand
- Sawyer & Kotonya, Lancaster University, UK
- Scott, Lawrence Livermore National Lab., USA
- Tremblay, UQAM, Canada
- Pigoski, USA
- Wallace & Reeker, NIST, USA
A Three-Phase Approach for Developing the Guide to the SWEBOK

1998 1999 2000 2001 2002 2003

Straw Man Version

Stone Man Phase (Trial Version)

Iron Man Version (Sub-phase 1)
Phase 2: Stone Man Review Process

Version 0.1

Limited number of domain experts

Review Cycle 1

Version 0.5

Selected users

Review cycle 2

Version 0.7

Community

Review Cycle 3

Version 0.9
Stone Man Review Process

- Transparency and consensus-building
  - All intermediate versions of documents are published and archived on www.swebok.org
  - All comments are made public as well as the identity of the reviewers
  - Detailed comment disposition reports are produced for Review Cycle 2 and 3
Data on reviewers

- Version 0.1: 33
- Version 0.5: 195
- Version 0.7: 378
  - + ISO reviews from 5 countries
Geographic Distribution of Reviewers

- USA: 55%
- Europe: 18%
  - 90 reviewers from 25 countries
- Canada: 10%
- Australia: 5%
- Asia: 5%
- Latin America: 4%
Education of Reviewers

- Doctorat: 34%
- Master: 39%
- Bachelor: 24%
- Other: 3%
Organizations of Reviewers (no. of employees)

- 0-50: 37%
- 50-500: 32%
- 500 more: 31%
Project Overview Presentation Plan

- Project background
- Project scope, objectives, audience and plan
- Contents of the Guide
  - How you can leverage the Guide within your organization
  - Conclusion
Stone Man 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
Guide to the Software Engineering Body of Knowledge
(Version 0.95)

- Software Requirements
  - Requirement Engineering Process
  - Requirements Elicitation
  - Requirement Analysis
  - Requirements Specification
  - Requirements Validation
  - Requirements Management

- Software Design
  - Software Design Basic Concepts
  - Key Issues in Software Design
  - Software Structure and Architecture
  - Software Design Quality Analysis and Evaluation
  - Software Design Notations
  - Software Design Strategies and Methods

- Software Construction
  - Reduction in Complexity
  - Anticipation of Diversity
  - Structuring for Validation
  - Use of External Standards

- Software Testing
  - Testing Basic Concepts and Definitions
  - Test Levels
  - Test Techniques
  - Test-Related Measures
  - Managing the Test Process

- Software Maintenance
  - Basic Concepts
  - Maintenance Process
  - Key Issues in Software Maintenance
  - Techniques for Maintenance

© IEEE
Software Requirements
Software Design
Knowledge Area Description

Classification of Topics

Matrix of Topics & References

References

Not implemented in Stoneman

Topic Descriptions

Classification by Vincenti’s Taxonomy

Classification by Bloom’s Taxonomy

References to Related Disciplines
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 Science (CC2001)
- Mathematics (CC2001)
- Project Management (PMBOK)
- Computer Engineering
- Cognitive Sciences and Human Factors
- Systems Engineering
- Management and Management Science
Project Overview Presentation Plan

- Project background
- Project scope, objectives, audience and plan
- Contents of the Guide

Next steps
- Research Issues
A Three-Phase Approach for Developing the Guide to the SWEBOK

Straw Man Version

Stone Man Version

Iron Man Version (Sub-phase 1)

Iron Man Version (Sub-phase 2)
Collection of feedback from:

Education:
- Curriculum design/evaluation
- Program accreditation
- Course design/evaluation
- Internal training, corporate universities
Collection of feedback from:

- Industry & Government
  - job description
  - hiring
  - staffing of projects
  - career planning
  - contracting
Collection of feedback from:

- Policy organisations
  - Licensing & Certification
    - licensing exam questions
    - study material
    - in software engineering and other IT fields
    - could be on subsets of Knowledge Areas
  - R & D agencies: strategies for increasing engineering maturity of the domain
A Three-Phase Approach for Developing the Guide to the SWEBOK

Straw Man Version

Stone Man Version

Iron Man Version (Sub-phase 1)

Iron Man Version (Sub-phase 2)
Project Overview Presentation Plan

- Project background
- Project scope, objectives, audience and plan
- Contents of the Guide
- Next steps

Research Areas
SWEBOK & Research Issues

- The **Engineering** of:
  - Software Requirements
  - Software Design
  - Software Construction
  - Software Testing
  - Software Maintenance
  - Software Quality
  - Software Eng. Management
  - Software Eng. Tools & Methods
  - Software Engineering Process
  - Software Configuration Management
Concluding Remarks

- **Software Engineering**: The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software
  - IEEE 610.12

- Strengthening the Engineering Knowledge within this new discipline is required for a rapid maturation, and significant contribution to the Canadian software industry