The Body of Knowledge and Curriculum to Advance Systems Engineering Project

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Agenda

1. BKCASE background and objectives

2. Systems Engineering Body of Knowledge status and plans

3. Graduate Reference Curriculum on Systems Engineering status and plans

4. Questions

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1. ***BKCASE background and objectives***

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How We Got Here

In Spring 2007, 3 phase effort was proposed:

1. A reference curriculum* for graduate software engineering with the "right" amount of systems engineering

2. A reference curriculum for graduate systems engineering with the "right" amount of software engineering

3. A fully interdisciplinary reference curriculum for systems and software engineering

*A reference curriculum offers recommendations on outcomes at graduation, entrance expectations, curriculum architecture, required knowledge, and possibly objectives. Recommendations are expected to be tailored. They do not specify course offerings or packaging.

You Are Here…

BKCASE™

DONE   *Phase 1.* A reference curriculum for graduate software engineering with the "right" amount of systems engineering

NOW   *Phase 2.* A reference curriculum for graduate systems engineering with the "right" amount of software engineering

FUTURE   *Phase 3.* A fully interdisciplinary reference curriculum for systems and software engineering

Phase 1 Primary Products

- Graduate Software Engineering 2009 (GSwE2009): Curriculum Guidelines for Graduate Degree Programs in Software Engineering

- GSwE2009 Companion Document: Comparisons of GSwE2009 to Current Master's Programs in Software Engineering

- GSwE2009 Companion Document: Frequently Asked Questions on Implementing GSwE2009

iSSEc

Integrated Software & Systems Engineering Curriculum (iSSEc) Project

Graduate Software Engineering 2009(GSwE2009)

**Curriculum Guidelines for
Graduate Degree Programs in Software Engineering**

GSwE 2009

Version 1.0

September 30, 2009

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www.GSwE2009.org

GSwE2009 Based on SWEBOK

www.SWEBOK.org
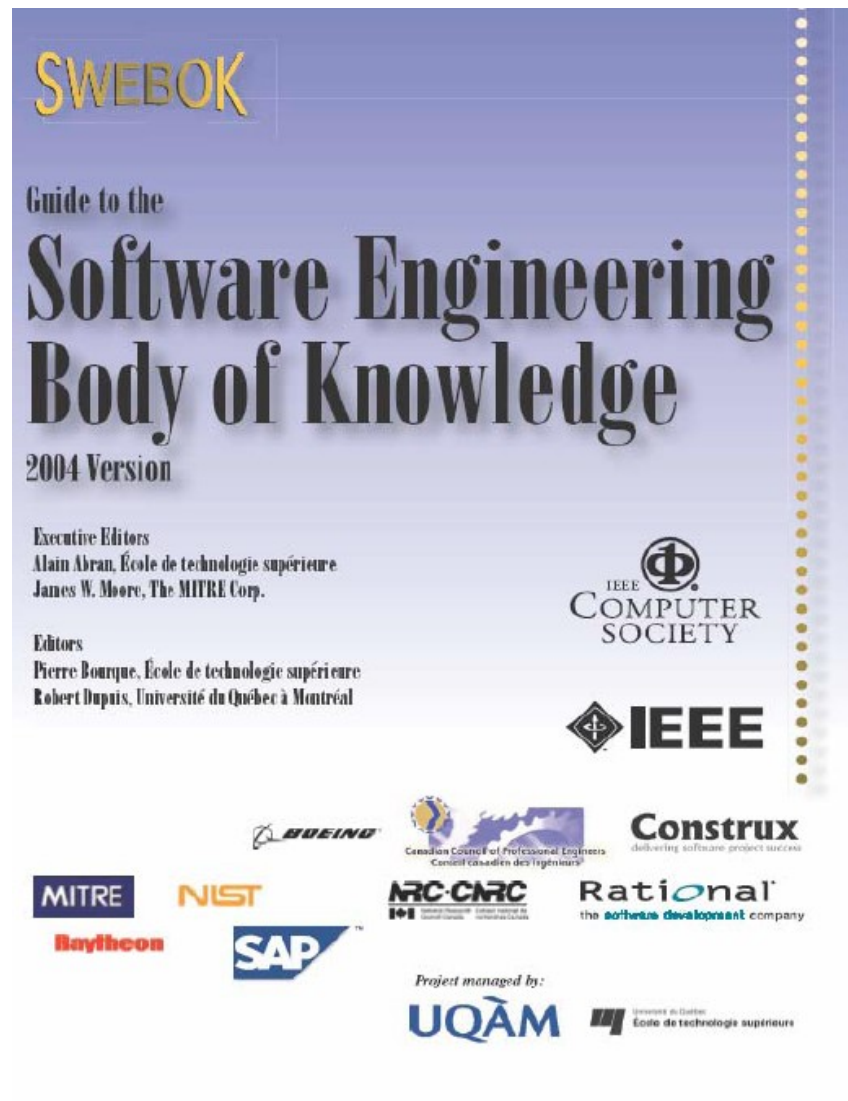
- SWEBOK is a way of organizing all the knowledge that is within the software engineering (SwE) discipline

- It is a hierarchical structure for the knowledge and references to key documents stating the knowledge as of 2004

- It was developed by a community of authors and reviewers from around the world

- It is static – it has not changed since it was published

- A refresh project is underway to produce a new version – parts of alpha version available now

What is BKCASE?

- Project to create:

  – Systems Engineering Body of Knowledge

  – Graduate Reference Curriculum in Systems Engineering (GRCSE™ – pronounced "Gracie")

- Started in September 2009 by Stevens Institute of Technology and Naval Postgraduate School with primary support from Department of Defense

- Project will run through 2012

- Intended for world-wide use

BKCASE Vision and Objectives

Vision

"Systems Engineering competency models, certification programs, textbooks, graduate programs, and related workforce development initiatives around the world align with BKCASE."

Objectives

1. Create the SEBoK and have it be globally recognized by the SE community as the authoritative guide to the body of knowledge for the SE discipline.

2. Create GRCSE and have it be globally recognized by the SE community as the authoritative guidance for graduate programs in SE.

3. Facilitate the global alignment of related workforce development initiatives with SEBoK and GRCSE.

4. Transfer stewardship of SEBoK and GRCSE to INCOSE and the IEEE after BKCASE publishes version 1.0 of those products, including possible integration into their certification, accreditation, and other workforce development and education initiatives.

Our Supporters

Under consideration

Under consideration

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Rules for BKCASE Activities

1. Products generated by the authors, not the sponsor or partners

2. Even though the Department of Defense is the sponsor, it does not have any authority over the content of the products, nor are the products slanted towards defense systems development and acquisition

3. Volunteer authors do the bulk of the writing

4. Core Team from Stevens and Naval Postgraduate School provides stable labor and direction

5. Core Team responsible for final integration, technical editing, and clean up of products

Agenda

1. BKCASE background and objectives

2. *Systems Engineering Body of Knowledge status and plans*

3. Graduate Reference Curriculum on Systems Engineering status and plans

4. Questions

SEBoK Value Proposition

1. There is no authoritative source that defines and organizes the knowledge of the SE discipline. Knowledge gap creates unnecessary inconsistency and confusion in understanding the role of SE and in defining SE products and processes.

2. Creating the SEBoK will help build community consensus on the boundaries of SE, including its entanglements with project management and software engineering.

3. A common way to refer to SE knowledge will facilitate communication among systems engineers and provide a baseline for competency models, certification programs, educational programs, and other workforce development initiatives around the world.

4. Common ways to identify metadata about SE knowledge will facilitate search and other automated actions on SE knowledge.

What is the SEBoK?

Describes the boundaries, terminology, content, and structure of SE that are needed to systematically and consistently *support and enable:*

Task Name	Task Description
Inform Practice	Inform systems engineers about the boundaries, terminology, and structure of their discipline and point them to useful information needed to practice SE in any application domain
Inform Research	Inform researchers about the limitations and gaps in current SE knowledge that should help guide their research agenda
Define Curricula	Define the content that should be common in undergraduate and graduate programs in SE
Certify Professionals	Certify individuals as qualified to practice systems engineering
Decide Competencies	Decide which competencies practicing systems engineers should possess in various roles ranging from apprentice to expert

Guide to the literature, not all the content of the literature

SEBoK 0.25 Table of Contents

State of SEBoK 0.25

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1. Version 0.25 released for limited review on September 15, 2010

   – 0.25 is prototype; 0.5 for early adopters; 1.0 for everyone

2. 656 pages long, 15 out of 16 chapters drafted, lots of very good material – more than expected at this point

3. Uneven maturity, too aerospace/defense, too process-oriented

4. More than 240 reviewers signed up – hoping for > 1000 comments – direction, topics, style, references, …

5. Reviews due December 15, 2010

6. All review comments will be adjudicated and adjudication published

BKCASE™

7. Case studies planned for early 2011 – domain-dependent material on Singapore water management system and on GPS system

8. Pointers to more than 700 books, articles, and websites divided into two broad categories: primary references and additional references/ readings.

9. Primary references are for anyone who wants to understand the most important information the chapter covers.

10. Additional references/ readings are noteworthy contributions or specialized writings that would selectively be of interest to readers.

Review Questions

1. Is stated purpose of the SEBoK correct?

2. Is intended audience of the SEBoK correct?

3. Is scope of the SEBoK correct; i.e., does SEBoK cover the right topics?

4. How would you improve the writing about any specific topic? Did we leave off an important concept or discuss a concept poorly?

Review Questions

5. Did we properly identify all the primary references for a topic? The additional references and readings? Are there references or readings missing? If so, please identify them.

6. Did we properly identify all the correct glossary terms? Were important terms left out or are the definitions incorrect or incomplete?

7. How well does the SEBoK currently satisfy its stated purpose?

8. The BKCASE Team plans to convert the SEBoK into a wiki-based format. What are the considerations for this format? What capabilities should be expected from this structure?

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GRCSE Value Proposition

1. There is no authoritative source to guide universities in establishing the outcomes graduating students should achieve with a master's degree in SE, nor guidance on reasonable entrance expectations, curriculum architecture, or curriculum content.

2. This gap in guidance creates unnecessary inconsistency in student proficiency at graduation, makes it harder for students to select where to attend, and makes it harder for employers to evaluate prospective new graduates.

3. GRCSE will fill that gap, becoming the "go to" reference to develop, modify, and evaluate graduate programs in SE.

GRCSE is being created analogously to GSwE2009 – in fact, using GSwE2009 as the starting text

Version 0.25 expected on December 17, 2010

GRCSE Is Being Created to...

1. Improve existing graduate programs in SE from the viewpoint of universities, students, graduates, engineering employers, and system buyers

2. Assist the development of new system-centric and domain-centric SE programs at the master's level by providing guidelines on curriculum content and advice on how to implement those guidelines

3. Support increased enrollment in SE programs by increasing the value of those programs to potential students and employers

4. Assist understanding the diversity of SE educational programs and assist prospective students and employers in having a basis to judge the suitability of a particular program for their individual purpose

What is in GRCSE?

- *Guidance for Constructing and Maintaining the Reference Curriculum:* the fundamental principles, assumptions, and context for the reference curriculum authors

- *Entrance Expectations:* what students should be capable of and have experienced before they enter a graduate program

- *Objectives:* what students should be able to achieve 3 to 5 years after graduation based on what they learn in program

- *Outcomes:* what students should achieve by graduation

- *Architecture:* the structure of a curriculum to accommodate core material, university-specific material, and elective material

- *Core Body of Knowledge:* material that all students should master in a graduate SE program

Not specific courses. Not specific packaging. Adaption and selective adoption expected and encouraged.

GRCSE 0.25 Draft Contents

Title - Chapters
1. Introduction
2. Guidance for the construction and maintenance of GRCSE
3. Expected objectives when a graduate has 3-5 years' experience
4. Expected outcomes when a student graduates
5. Expected student background when entering master's program
6. Curriculum architecture
7. Core body of knowledge (CorBOK)
8. Assessment
9. Anticipated GRCSE evolution

Title - Appendices
App A. Summary of Graduate SE-centric SE programs in 2010
App B. Bloom's taxonomy of educational objectives
App C. Assessment and achievement of learning outcomes
App D. Discussion of program emphases
References
Glossary
Index

Early Draft Decisions /Challenges

Challenge	Early Decision for GRCSE 0.25
Should GRCSE scope include Domain-Centric SE programs or just Systems-Centric programs?	Systems-Centric only
How much experience should be expected of program entrants?	At least 2 years of practical experience in some aspect of SE
Focus on traditional product SE or on services and enterprise SE as well?	All 3 – product, services, and enterprise SE
One set of outcomes and objectives or several sets, reflecting the range of SE educational practice?	One set

Decisions will be revisited for GRCSE 0.5

Early Draft Decisions /Challenges

Challenge	Early Decision for GRCSE 0.25
Expect an undergraduate degree in engineering, physical science, computer science, or mathematics?	Yes
Program be ABET (or equivalent) accreditable	?
How much content should be standardized?	No more than 50%
Learn SE abstractly or in the context of an application domain	In context of application domain

Decisions will be revisited for GRCSE 0.5

If We Are Successful...

SEBoK will strongly influence the INCOSE SE Handbook Version 4, the INCOSE SE Professional Certification Program, DoD SE competency efforts, will highlight places where research is needed, become a standard reference for practitioners, and improve the quality and richness of communication among systems engineers worldwide.

GRCSE will clearly distinguish between graduate and undergraduate education in SE and influence the content of both undergraduate and graduate SE programs worldwide.

BKCASE

Interested in helping? We need reviewers (especially for GRCSE), subject matter experts, and a few more authors

www.BKCASE.org

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SEBoK

    Version 0.25 available September 15, 2010 – prototype
    Version 0.5 available September 2011 – early adopters
    Version 1.0 available September 2012 – general use

GRCSE

    Version 0.25 available December 17, 2010 – prototype
    Version 0.5 available December 2011 – early adopters
    Version 1.0 available December 2012 – general use

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