Systems Engineering
Body of Knowledge and Its Integration
with Software Engineering

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What is BKCASE?

- Project to create:

  - **Systems Engineering Body of Knowledge (SEBoK)**

  - **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. Modeled on previous work for the Software Engineering community, but a bit more ambitious.

- Project will run through 2012

- Intended for world-wide use

What is the SEBoK?

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

| 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

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

- ***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.

Our Partners
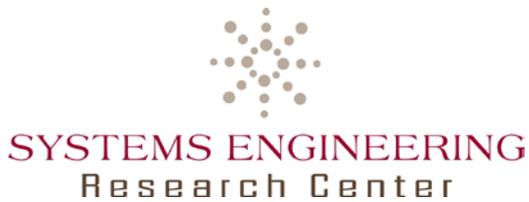
Under consideration

SEBoK 0.5 Anticipated TOC

Part I: A guide to the SEBoK itself – Why does it exist? What is in it? How will different people use it?

Part II: A guide to knowledge about systems – What types of systems exist? What fundamental principles help explain systems?

Part III: A guide to knowledge about SE practice – How is SE performed? What are typical SE activities?

Part IV: A guide to knowledge about SE deployment and sustainment – When is SE performed? Who performs it? How is it enabled by an organization?

Part V: Implementation Examples – What do existing case studies reveal about SE knowledge and practice? How does SE practice vary by domain and system type?

SEBOK way ahead

- Version 0.50 planned for release in late summer/early fall 2011.

- V0.50 will be a Wiki release.

- Will open to general public review for three months.

- Will adjudicate public comments and revise document as necessary.

- Will publish Version 1.0 in late summer/early fall 2012.

- Will transition to stewardship of the professional societies by end of 2012.

SEBoK

BKCASE™

Part 1
Part 2
Part 1
    KA 1
    KA 2
      Topic 1
      Topic 2
    KA 3
Part 4
Part 5

SEBoK Home

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Topic 2 (Article Title)

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Comment Entry Area (access controls TBD)

Comment 1: User XXXXX
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Comment 2: User XXXX
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Citations

Citation 1
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Related Primary References

Reference 1
Reference 2
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Glossary

Term 1
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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.

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

Version 0.5 expected in December 2011

GRCSE 0.25 Table of Contents

Title - Chapters
1. Introduction
2. Guidance for the construction 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. Systems engineering competency frameworks
App D. Untitled – probably Assessment and curriculum
App E. GRCSE outcomes CorBOK mapping
Glossary
Index

About 120 pages for V0.25.

Stewardship

- INCOSE and IEEE CS have formed with the BKCASE team a committee of 6 to develop the agreement for the eventual (2012) transfer of stewardship of BKCASE to INCOSE and IEEE.
  - IEEE CS will work with IEEE Sys Council to clarify roles internal to IEEE.
- Committee is Dick Fairley, Kevin Forsberg, Tom Hilburn, Bill Miller, Art Pyster, and Dave Olwell

Software Engineering: Some background

- Much of the value of a system today is from software. Software is pervasive across all domains.

- SwEBoK under revision, due out in 2011-2. Last version dated 2004. 2004 version has 10 knowledge areas, 2011-2 will have 15.

- GSwE2009 published in 2009. Used as model for GRCSE.

Goals

- SEBoK will align with and point to SwEBOK. It will not duplicate.

- SEBoK /GRCSE will focus on what an SE needs to know about SwE, not what an SwE needs to know about SwE.

- Architectures will be a unifying theme. SW has architectural styles different from hardware, and SE must comprehend.

Progress for v0.50

- Part one will discuss the entanglement of SE and SwE.

- Part three will include information about how SE's engage with SwE in the practice of SE.

- GRCSE will require SE's be educated in SwE, and SwE has heavier emphasis than any other engineering discipline.

- We want to improve coordination with the SwEBoK team.

- Much discussion about what else to do.

Insights

- SEs tend to focus on functional decomposition. SwEs to focus on objects. SEs need to understand variations for software.

- Treatment of SwE is causing difficulty in the writing of the SEBok. Seems inappropriate to place in just one KA, but addressing it in every KA seems unfocused. We are struggling.

- The treatment of entanglement needs to percolate to architecture, verification, the – ilities, etc.

Watchdogs

- Art Pyster is championing the inclusion of SwE in both SEBoK and GRCSE. He is looking for help in that role.

- Barry Boehm, Tom Hilburn, Ken Nidiffer are on the BKCASE team and are also passionate about the integration of SE and SwE in the products.

Summary

- The issue is important and is receiving much attention from the BKCASE team.

- We had hoped to say more, but the issues have not resolved. We do expect clarity by this summer as we finalize V0.50.

- Assistance gratefully received, both now and as reviewers.

Questions?

www.BKCASE.org

bkcase @stevens.edu

Acronyms

- BKCASE: Body of Knowledge and Curriculum to Advance Systems Engineering

- GRCSE: Graduate Reference Curriculum in Systems Engineering

- GSwE2009: Graduate Software Engineering 2009

- KA: Knowledge Area

- SE: Systems Engineering

- SEBoK: Systems Engineering Body of Knowledge

- SwE: Software Engineering

- SwEBoK: Software Engineering Body of Knowledge

- TOC: Table of Contents