Applying Systems Thinking via Systemigrams™ for Defining the Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE) Project

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Abstract. Systems thinking is commonly accepted as the backbone of a successful systems engineering approach. As such, the Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE) team chose to leverage a systems thinking based tool, called Systemitool, to describe our project to the vast audience that would potentially become involved directly or indirectly in the success of the project. This paper describes the process and steps used by the authors and the BKCASE team to develop the project's systemic diagram, or Systemigram™, and the story behind the project, the products, and the vision of the BKCASE project. The goal of the paper is to provide guidance so that readers can leverage the lessons learned from this effort to successfully develop their own project definitions and stories.

Introduction

In the development of a competency framework for Systems Engineering (SE), the International Council for Systems Engineering (INCOSE) includes systems thinking as one of three main categories (the other two being holistic life cycle view and systems engineering management) of the framework. INCOSE's systems thinking category includes three competencies that the team believes a systems engineer should possess: 1) an understanding of general systems concepts, 2) an understanding of the role of the system within the larger system of which it is inevitably a part, and 3) an understanding of the system context within the larger enterprise and technological contexts. (INCOSE UK, 2006) As part of her PhD dissertation work, Dr. Heidi L. Davidz (2006) found that "the primary mechanisms that enable systems thinking development include experiential learning, various individual characteristics, and a supporting environment." (Davidz, p. 5) One way to promote systems thinking is in the successful demonstration of the use of systems thinking. This paper describes the phases used to apply a systems thinking methodology, through the use of the Systemitool, to the definition of the Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE) project.

Background

As described in Squires (2009), BKCASE is a three-year effort to produce two version 1.0 products: a Systems Engineering Body of Knowledge (SE BoK) and a Graduate Reference Curriculum in System Engineering (GRCSE, pronounced "Gracie"). The project was kicked off in September 2009 by the Stevens Institute of Technology, together with the Naval Postgraduate School, and with significant funding and support from the U.S. Department of Defense. The project is endorsed by the INCOSE Board of Directors and supported by the IEEE Systems Council and IEEE Computer Society. The BKCASE team includes invited authors and volunteer reviewers from around the world and has representation from government, industry and academia. Once fully staffed, the team will have thirty to forty authors and several hundred reviewers. The project charter for BKCASE is provided in Appendix A, and the project is further addressed through the Systemigrams^{TM} (*See endnotes), reviewed throughout this paper. Additional information can also be found on the project website: `www.bkcase.org`. Some of the challenging areas that are being addressed by the project team are described in the white paper in Appendix B. These challenges include coming to consensus on the boundary or scope of systems engineering, defining the approach or framework for the SE BoK and GRCSE and dealing with diverse terminology across various disciplines and domains that use systems engineering (even though they may call systems engineering by another name).

Due to the challenging nature of the BKCASE project, communicating the project intent and strategy across the broad audience that will be potentially be participating in the project is an important first step. According to John Boardman Associates (JBA), the Systemitool is designed to "Transfer understanding – the tool includes presentation facilities, while the intuitive mode of representation makes your diagrams swiftly comprehensible." (JBA, 1999) Blair (2007) used Systemitool to develop a Systemigram^{TM}-based story that demonstrated the strategic intent of U.K Ministry of Defense policy makers in the development of network enabled capability. Systemigrams^{TM} created from Systemitool were used in Mansouri (2009) as an enabler for shared understanding of Maritime Transportation System of Systems stakeholder perspectives, needs and strategies. Sivadasan (2009) used Systemitool to create Systemigrams^{TM} to demonstrate a systems perspective of the issue of increasing plagiarism in the academic community. An initial set of rules for Systemigram development can be found in Blair (2007) and Sivadasan (2009). Many Systemigram examples and a more thorough discussion of systems thinking can be found in Boardman (2008). Systemitool was chosen by the BKCASE team to pictorially demonstrate the strategic intent, value proposition, and objectives of the project and to tell the BKCASE story; and the process that was used is explained in the body of this paper.

The Process

The authors and BKCASE team leveraged the following phases and guidelines in the development of the BKCASE Systemigram.

Phase I. ***Create an initial diagram from established prose.*** The initial project Systemigram shown in Figure 1 was created using the Project Charter shown in Appendix A. This project charter was originally developed by the core BKCASE team during their initial project kickoff meeting and documented in final form in the week following the kickoff.

In the initial Systemigram, the project vision was used for the mainstay of the system story. This mainstay is shown from the top left hand bubble, *BKCASE*, across the top of the diagram down the right hand side to the lower right hand bubble, *SE Community*. The remainder of the diagram was fashioned from the objectives, project strategy and value propositions and characteristics of the two main products SE BoK and GRCSE, as described in the Project Charter in Appendix A. The goal was to provide a diagram of the entire project in one page, focusing on the main components and relationships that were critical to a successful project. This initial Systemigram was informally presented to the BKCASE team; and team members provided feedback that was used to compare to the rules of Systemigram development in Phase II.

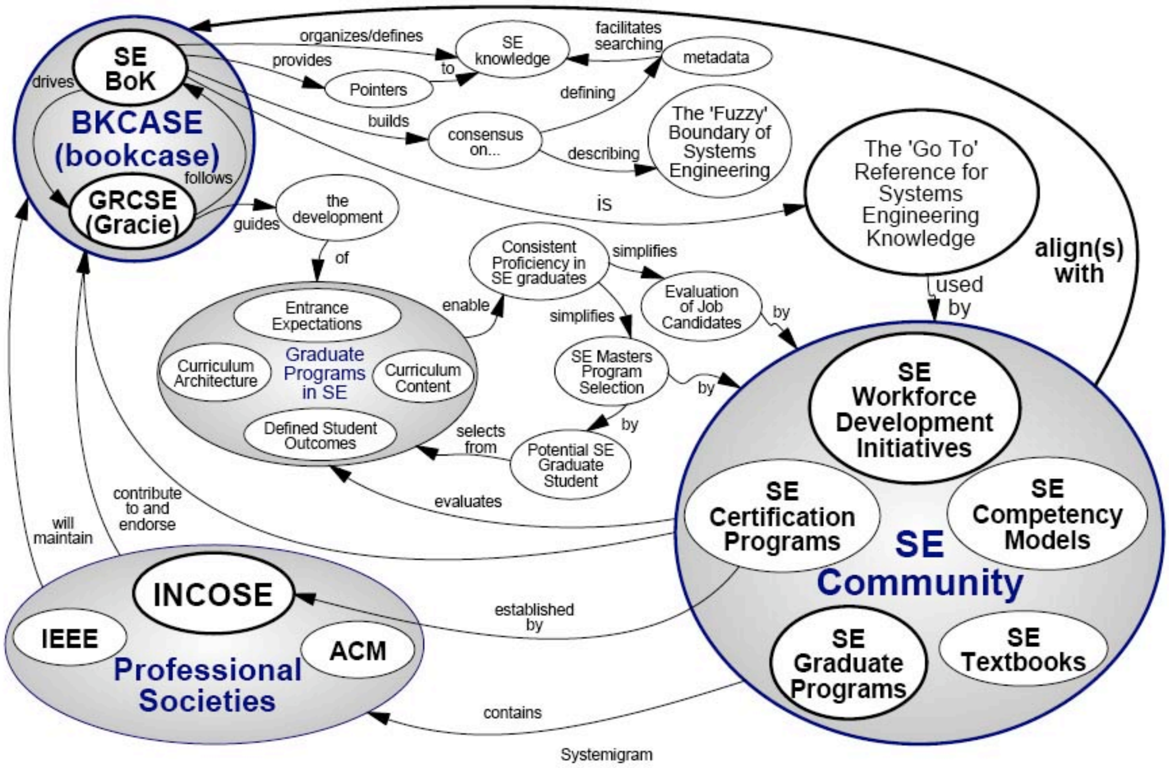

Figure 1. Translating the Project Charter into an Initial Systemigram

Phase II. ***Compare the resulting diagram to the rules of Systemigram development and update accordingly.*** The rules for creating a Systemigram are based on extensive research and the following guidelines:

- rules should provide value, not constraints
- rules should be based on proven research methods
- rules should support intellectual flexibility of the modeler

In our case, the Systemigram author (Squires) had access to a Systemigram expert (Sauser) with which to review the diagram. The established rules that came into play and how they were applied were as follows:

- <u>The upper left hand corner of the diagram starts with the system being described.</u> In our case, we confirmed this was *BKCASE* (pronounced 'bookcase'), as shown.

- <u>The lower right hand node and the mainstay (bolded) should represent the end purpose of the system.</u> *SE Community*, shown in the lower right hand corner as part of the mainstay, was not in itself the end purpose. While the *SE Community* is an important component of the story and part of the vision of the project, this node was better represented as a critical node in the 'center' of the system, rather than as the purpose node.

- <u>A relationship should not end at a node in the 'middle' of the diagram.</u> For example, see: *The 'Fuzzy' Boundary of Systems Engineering* node. There were several reasons that a relationship might end in 'random' node like this. First, the node may not be needed. Second, there may be a missing relationship coming from the node. Third, the node itself may need to be corrected or the diagram in this area revamped.

- Relationships can be phrases, that is, nodes should not be defined simply because a noun is involved. For example, see: *guides the development of*, shown in Figure 1 as three elements in the diagram: a relationship, a node, and a relationship. These three elements could be better shown as one relationship (no nodes needed) between the two nodes *GRCSE* and *Graduate Programs in SE*. The point is that verb or prepositional phrases are common and desired as part of a Systemigram and the noun parts of a phrase do not necessarily need to be nodes in the diagram; they can remain part of the phrase itself, as appropriate.
- Connection nodes, or any node that has multiple nodes inside, is used to collect nodes that belong to one specific group. In Figure 1, for example, the *SE Community* node contained elements that did not appear to be part of the community. In fact, a community in the sense that it was intended for this diagram, consists of collections of people rather than collections of items.
- Systems should only be shown in one place. The *SE Graduate Programs* shown in the *SE Community* bubble is the same element as the *Graduate Programs in SE* shown as a collection node in Figure 1.

These discrepancies would need to be addressed in the next version of the Systemigram; the new diagram that resulted from this phase of the process is shown in Figure 2.

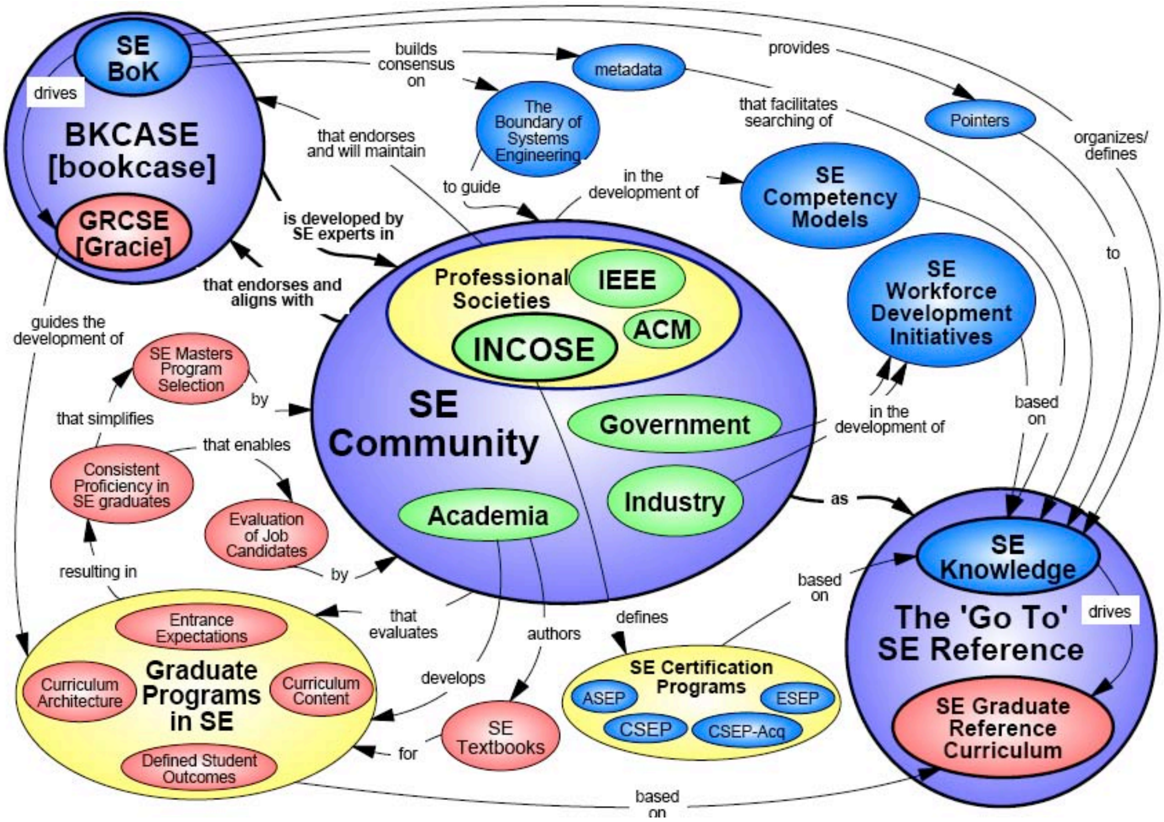

Figure 2. The First Formal Version of the Systemigram

In this version, the mainstay or purpose is shown along a diagonal through the diagram from

BKCASE, through the *SE Community*, to *The 'Go To' SE Reference* products. The *Professional Societies* became part of the *SE Community* where they belonged along with *Government*, *Industry* and *Academia*. Artifacts previously shown as part of the *SE Community* were segregated from that connection node. Duplicate systems and 'hanging' nodes were eliminated; and superfluous nodes become part of relationship phrases. This was the first official version of the project Systemigram formally presented to the core team, as outlined in Phase III.

Phase III. ***Present the Systemigram to the core project team and reach consensus.*** This phase of the task can go through several iterations before finally coming to a consensus. Initially, the core team struggled with Figure 2 for several reasons. First, the end node at the lower right hand corner acted like a sink; arrows only went into the node, and nothing was shown as coming out. When the author described the intent to the team, it became clear that the BKCASE products were duplicated. Products were essentially being shown in both the upper left hand corner bubble, as well as the lower right hand corner bubble. Relationships were primarily sourced from the upper right bubble and all the relationships were received into the lower right hand bubble. This did not accurately portray the project in the minds of the core team and more work was needed. The final result is shown in Figure 3.

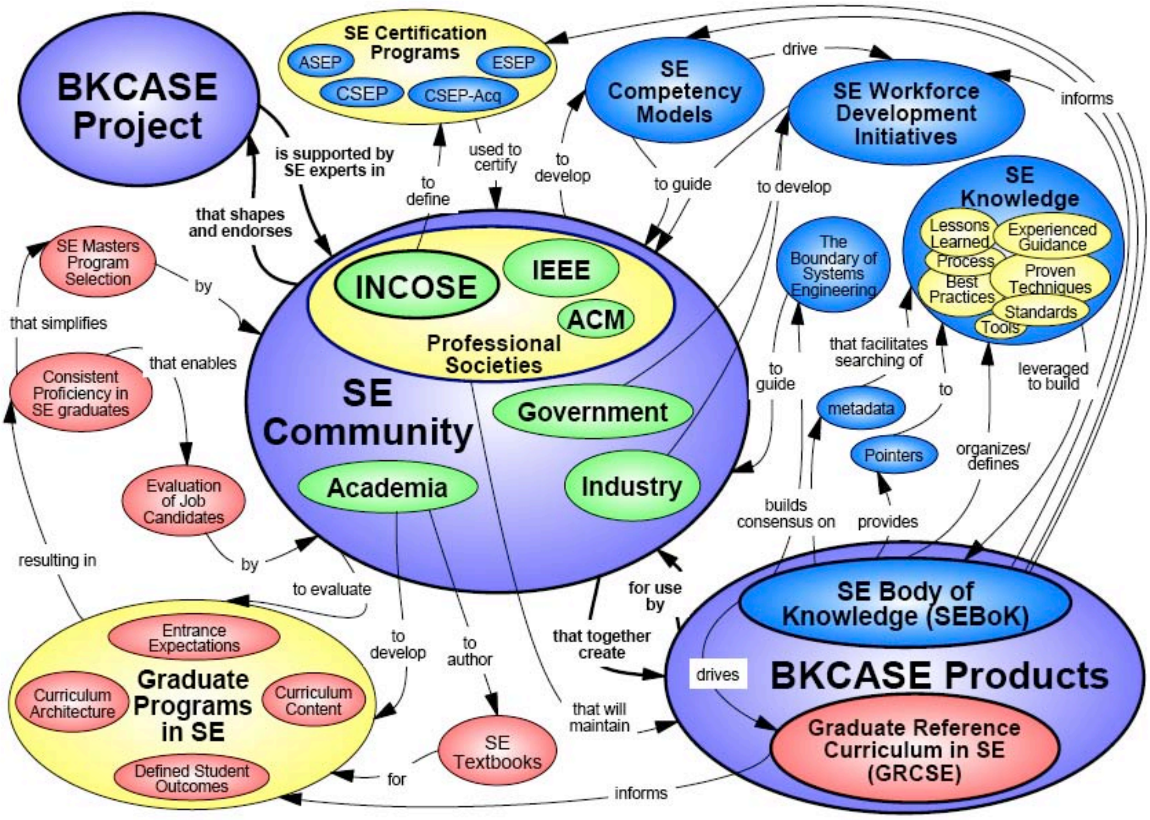

Figure 3. The Final BKCASE Team Version of the Project Systemigram

Ultimately, the BKCASE products were shown in the bottom right hand bubble as the outcome and main purpose of the project. *SE Knowledge* was moved out of this bubble and into the main part of the Systemigram. Further detail was added to the *SE Knowledge* bubble as a result of feedback from and initial meeting with the core team and nearly two-dozen future authors on the project. The Systemigram author also decided to keep the SE BoK product nodes and relationships above the diagonal and the GRCSE product nodes and relationships below the diagonal. This required moving the *SE Certification Programs* connection node from the bottom of the diagram and under the diagonal, to the top of the diagram and above the diagonal.

This decision helped streamline the project story developed in Phase IV.

The final Systemigram can become quite complex and overwhelming to absorb all at once. Once the team agrees on the project diagram; it is time to create the project story. The process for creating the story is outlined in Phase IV.

Phase IV. *Create the project story.* Once the project diagram is to a level that the core project team is satisfied of its accuracy and effectiveness in portraying the project; then it is appropriate to create the project story. A mature Systemigram can be 'read' such that the nodes and relationships tell a story. Creating the story earlier than this phase may result in significant rework. The project story starts with the mainstay or purpose of the project, and then each of the major sections of the project are shown and explained in isolated diagrams that together form the whole of the Systemigram. For this project, the story can be heard and seen in detailed by referring to the project website: `www.bkcase.org`. The BKCASE story is comprised of three main sections: the mainstay, the Systems Engineering Body of Knowledge (SE BoK), and the Graduate Reference Curriculum for Systems Engineering (GRCSE). The story of BKCASE starts with Figure 4, the mainstay of the Systemigram.

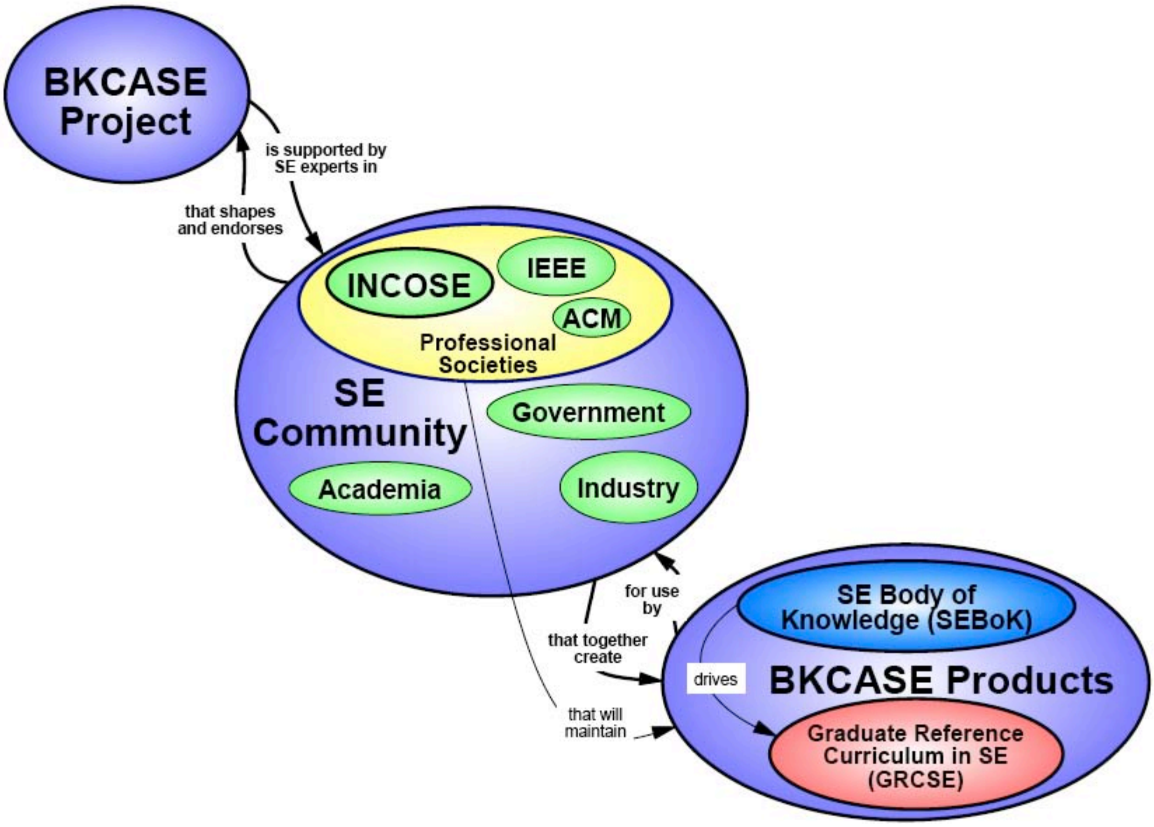

Figure 4. The BKCASE Mainstay

As an example of the BKCASE story, referring to Figure 4, one can read the Systemigram as follows: "The BKCASE project is supported by SE experts in the SE Community that together create BKCASE products (SE BoK and GRCSE) for use by that same SE Community that shapes and endorses the BKCASE project." This completes the first loop of the BKCASE story. In addition, from the same Figure 4, one can see that another goal for the project is that the *Professional Societies* will maintain the *BKCASE Products* once the project is completed after the three-year period. The second part of the story, as shown in Figure 5 in completed form, describes the *SE BoK* product and how that product will be created and applied to *SE Workforce Development Initiatives*, *SE Competency Models*, and *SE Certification Programs*. The applicable parts of the Systemigram are shown to complete that part of the story. The third and final part of the BKCASE story is shown in completed form in Figure 6. This part of the story addresses the *GRCSE* product and shows how that product will be applied to the development of *Entrance Expectations*, *Defined Student Outcomes*, *Curriculum Architecture*, and *Curriculum Content* of *Graduate Programs in SE*.

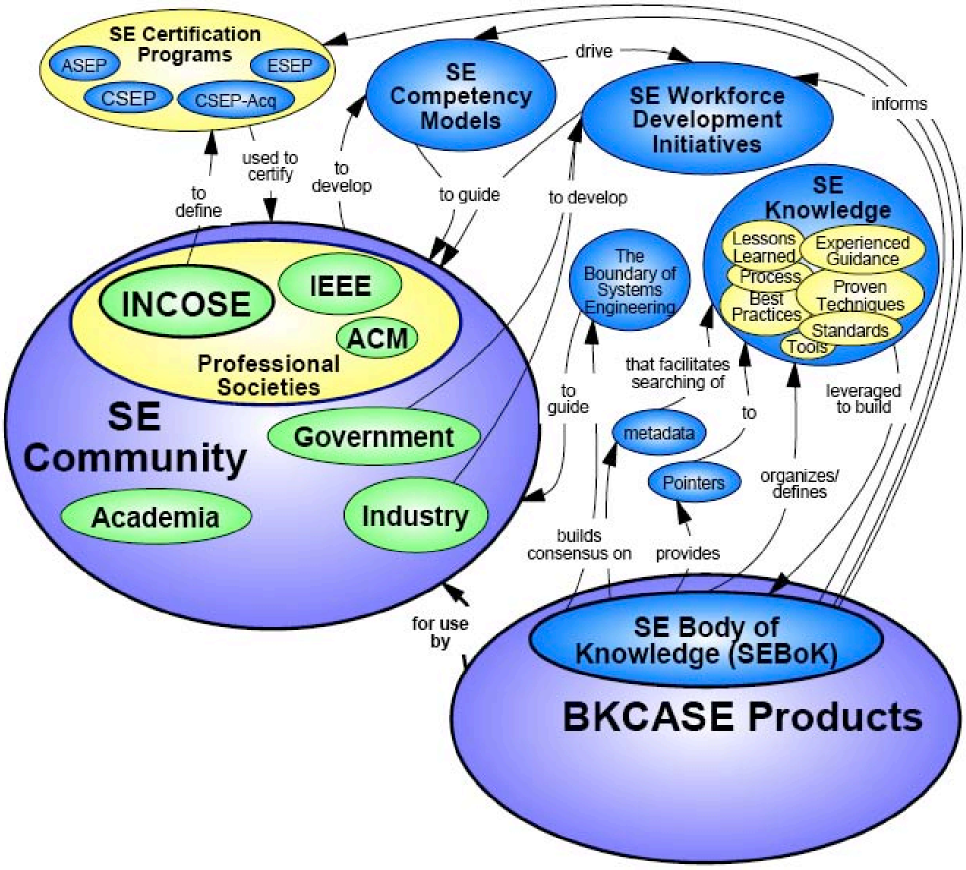

Figure 5. The Systems Engineering Body of Knowledge (SE BoK)

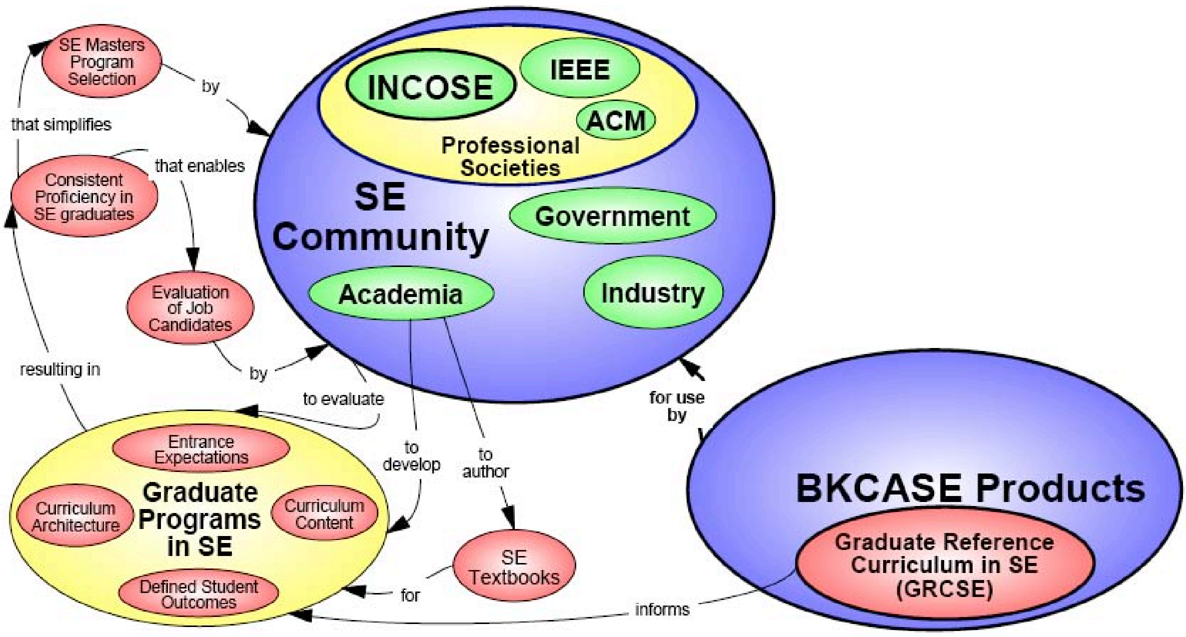

Figure 6. Graduate Reference Curriculum for Systems Engineering (GRCSE)

Lessons Learned

The Systemigram created directly from the prose was confusing even with the guidance and support of the Systemitool. One could see the elements of the project but the Systemigram did not tell the complete story. By going through the Systemigram rules and leveraging a Systemigram expert, we advanced the diagram to the next level and the diagram was effectively reviewed and critiqued by the project team and improved further.

Another lessons learned is that understanding all the phases of the Systemigram development process up front can help in making the right decisions in the development of the diagram earlier in the cycle. For example, as previously mentioned, because there are two main products for this project, it helped tremendously when it came time to tell the story, that the nodes and the relationships for each product were nicely divided above and below the main diagonal of the project mainstay.

The most important lesson learned pertaining to the use of the Systemitool to describe a project, was our team's decision to adopt the approach that the top left hand bubble represented the project and relationships associated with project management and support, and the bottom right hand bubble represented the products to be produced or outputs of the project, and the corresponding relationships. This approach simplified the development of the Systemigram and made a significant difference to our team's understanding of the Systemigram and its message. Following this guideline may be of general benefit when using the Systemitool to define a project. Please note that when using this approach, for a service-oriented project, the bottom right hand bubble would represent the services provided. Also, since a Systemigram is typically 'read' from the upper left hand corner and many different pathways lead to the lower right hand corner, we found it was more intuitive to expand the reading of the Systemigram to create loops from the project in the upper right hand corner, to the products in the lower right hand corner, and back again.

As far as the actual tool used to create the Systemigram, one downside of the Systemitool was the manual nature of creating the actual diagrams; lines and connection points had to be constantly readjusted and it was sometimes difficult or impossible to adjust the lines as desired. The tool currently only runs on a Windows operating system, and there is only the most basic help provided in the Help menu. However, the tool provided a faster method than drawing the diagram using a typical drawing tool and the tool includes the ability to create a story showing only those parts of the Systemigram provided from one slide to the next. However, the slides are not compatible with PowerPoint; although they can be exported into a pdf format and then converted to common jpeg image files that can then be inserted into PowerPoint slides.

One overall lesson learned from the experience is that one should expect to go through several major revisions of the Systemigram as part of a typical and successful process. Also, phase III and IV may need to be repeated, as feasible, based on additional feedback or findings during the project development cycle.

Summary

Creating the Systemigram allowed the team to explain the BKCASE project in a way that was interesting, memorable, and captivating. For example, one new member of the team mentioned that the BKCASE story was pleasurable to hear and that they really had not understood the intent of the project until they were presented the Systemigram story. Systemitool is an extremely basic drawing tool that allows one to apply systems thinking to develop a visually pleasing and intuitively comprehensible description of a system.

Acknowledgements

The authors are indebted to the entire BKCASE team. The original core team consists of Art Pyster and Alice Squires from the Stevens Institute of Technology, David Olwell and Stephanie Few from the Naval Postgraduate School, and Don Gelosh from the Department of Defense. Jim Anthony from the Department of Defense joined the team next. And more recently, since the writing of the original paper for the INCOSE Symposium 2010, Nicole Hutchinson from ANSER has joined the core team.

Appendix A: BKCASE Project Charter

Please note: This original BKCASE project was developed as a joint effort by the first five members of the core BKCASE team mentioned in the Acknowledgements of this paper. The charter is dynamic and will evolve with the project.

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

BKCASE Objectives:

1) Create a SE BoK that is globally recognized by the SE community as the authoritative BoK for the SE discipline.
2) Create a graduate reference curriculum for SE (GRCSE – pronounced "Gracie") that is 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 SE BoK and GRCSE.
4) Transfer stewardship of SE BoK and GRCSE to INCOSE and other suitable professional societies after BKCASE releases version 1.0 of those products.

Value Proposition for SE BoK:

- There is no authoritative source that defines and organizes the knowledge of the SE discipline, including its methods, processes, practices, and tools. The resulting knowledge gap creates unnecessary inconsistency and confusion in competency models, certification programs, educational programs, and other workforce development initiatives around the world. SE BOK will fill that gap, becoming the "go to" SE reference.
- The process of creating the SE BoK will build community consensus on the boundaries of SE – what is in and what is out of SE, although those boundaries will likely be fuzzy in places.
- Having a common way to refer to SE knowledge will facilitate communication among systems engineers. Having common ways to identify metadata about SE knowledge will facilitate search and other automated actions on SE knowledge.

Value Proposition for GRCSE:

- There is no authoritative source to guide universities in establishing the outcomes graduating students should achieve with a master's degree in SE, nor on reasonable entrance expectations, curriculum architecture, or curriculum content. 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 will fill that gap, becoming the "go to" reference to develop, modify, and evaluate graduate programs in SE.

Project Strategy:

1. Publish incrementally/iteratively with SE curriculum reference trailing SE BoK.
2. Throughout the project, involve professional societies to facilitate quality, acceptance, and their eventual role as stewards.
3. Build early consensus and maintain it throughout the lifetime of the project.
4. Rely on and include academia, industry, and government for authors and reviewers.
5. Extensively leverage volunteer labor for both authoring and review.
6. Rely on existing source material wherever possible and involve principals from efforts that created source material wherever possible.
7. Leverage the processes used to create Graduate Software Engineering 2009 (GSwE2009) Curriculum and the Naval Postgraduate School Modeling and Simulation Acquisition Curriculum.
8. Keep completely open and collaborative at a global level.
9. Hold physical workshops every 3 months to synchronize teams and build team relationships – rely on virtual meetings, email, and other collaboration technology at other times.
10. Keep the team focused on the value propositions when conflicts arise.

SE BoK Characteristics:

1. Provide a guide to "all" SE knowledge, but not the knowledge itself, offering "pointers" to knowledge sources in SE
2. Be authoritative by virtue of the gravitas of the authors, endorsement by professional societies, and adoption by the community
3. Include a taxonomy of the knowledge – "all" SE knowledge fits within the SE BoK
4. Define the boundaries of SE; some knowledge will be unambiguously included in SE; some will be at the boundary and its inclusion will be fuzzy. Fuzzy inclusion is an advantage in a field that is evolving as rapidly as SE.
5. Organize (categorizes) knowledge for fast and efficient retrieval
6. Provide a baseline of SE knowledge at a given time, but be structured to facilitate evolution as new knowledge emerges (additional "pointers") and the field itself changes (changes in taxonomy)

SE Reference Curriculum Characteristics:

1. Provide student outcomes on graduation, expectations for students at entrance, curriculum architecture, and core content that all graduates should master – analogous to GSwE2009.
2. Require student to know or learn about the application of SE in an application domain or business segment.

3. Include companion documents to GRCSE that facilitates understanding how current graduate programs compare to GRCSE guidelines and offers advice to faculty on how to adopt GRCSE guidelines.

Team Composition:

1. Stevens Institute of Technology will lead BKCASE. Art Pyster will be the Principal Investigator and editor with Alice Squires as the primary researcher supporting the project. Additional faculty and staff support will be provided as required.
2. The Naval Postgraduate School co-leads BKCASE. David Olwell will be the Co-Principal Investigator and co-editor. Stephanie Few will be the primary research associate supporting the project. Additional faculty and staff support will be provided as required.
3. Volunteer authors will work an average of about 1-2 days per month, attend quarterly workshops and participate in periodic virtual meetings. Approximately 30-40 authors will be sought representing different locales and business segments. Some authors will work on both SE BoK and GRCSE; others will work on only one product.
4. Volunteer reviewers will work as their time permits. Several hundred reviewers will be sought, representing different locales and business segments. Some reviewers will review both SE BoK and GRCSE; others will review only one product.
5. INCOSE will provide 3 volunteer authors and will encourage volunteer reviewers to participate from their membership.
6. Don Gelosh will be the technical point of contact for the U.S. Department of Defense and will coordinate its additional participation, including funding support.
7. Participation of other professional societies, such as the IEEE, will be sought.

Draft Schedule:

This schedule is notional to provide general insight into when products are anticipated. The real schedule will emerge after the author team is assembled and work begins.

September 2009	BKCASE project begins
June 2010	Version 0.25 SE BoK
September 2010	Version 0.25 GRCSE
June 2011	Version 0.5 SE BoK
September 2011	Version 0.5 GRCSE
June 2012	Version 1.0 SE BoK
September 2012	Version 1.0 GRCSE

Appendix B: BKCASE White Paper

Please note: The BKCASE white paper represents a synopsis of a series of discussions of the core BKCASE team.

Preparing for the First BKCASE Author Workshop

This paper assumes you are already familiar with the Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE) project and the two BKCASE products, a robust Systems Engineering Body of Knowledge (SE BoK) and a Graduate Reference Curriculum in

System Engineering (GRCSE, pronounced "Gracie"). For a review of the BKCASE project, please see the recording and presentation with notes, at `www.bkcase.org`. A short article on the project will also be in the December version of the INCOSE Insight.

The purpose of this paper is to initiate the process of reflective and critical thinking that must take place for the BKCASE project to be successful. The hope is that members of the author team will be better prepared for the upcoming author workshop after reviewing the material provided and taking time over the next few weeks to consider (think about) the areas and points summarized in this paper. The areas selected were thought to be the more challenging or debatable areas in systems engineering for our project. The areas fall into three broad categories: the boundary or scope, the development approach, and terminology. Within each area some typical issues and thought points are listed. The issues and points listed within each area are not meant to bias thinking in any one direction; and any appearance of this is unintentional. Nor are the areas, issues and points meant to be all-inclusive. Rather, these are intended as 'thinking' starters. Suggestions or comments are welcome, as always.

The Systems Engineering Boundary

Issues:

- There is no globally accepted definition of systems engineering.
- Systems engineering means different things to different people.
- Systems engineering is used across many different domains in different and possibly conflicting ways.
- It will be difficult to come to a consensus on the major boundaries of the discipline including where the boundary is more definite versus where it may remain 'fuzzy'; that is: what's in, what's out, and what's fuzzy.

Thought points:

- Where do we start? With expected outcomes or the ideal end game? With a clear definition of the problem?
- How do we address systems engineering centric versus domain centric systems engineering considerations?
- Where do systems engineering processes versus systems engineering artifacts versus formulas for systems engineering fit in?
- Should we address the standardization of a problem solving framework and identification of the root cause as part of the scope?
- How should we deal with different types of systems engineers and the applicable workforce requirements and employee competency/skill sets when defining the boundary?
- Where does graduate versus undergraduate versus K-12 education fit in?

The Approach for Developing the SE BoK and GRCSE

Issues:

- It will be difficult to come to a consensus on the best approach; furthermore, the best approach may be different for each of the BKCASE products, compounding the issue.

- The BKCASE products must accommodate future growth that is not known or predictable in an environment that is constantly changing.
- The BKCASE products must be maintained over time outside of the current funding structure.
- One of the main BKCASE project strategies is to keep the project open and collaborative at a global level. The project leverages a team of authors some of which are principals on efforts that created source material and a subset of these are proprietary; we need to ensure the BKCASE products will be non-proprietary and open at all times.
- We have to succeed where others have not.

Thought points:

- What has been done before? What worked? What didn't work?
- What is a robust approach that allows for adaptability – changes in the approach as we reach consensus on the various aspects –where the requirements as we understand them will evolve and change? Should we create an 'Adaptive' SE BoK?
- How can the approach be flexible to allow for a variety of methods for everything from development to implementation to search to addition or replacement?
- What do we need to do to ensure the products are maintainable in the long term within a reasonable cost and schedule structure and still meet the need to evolve the content so that the content remains current, accurate and complete?
- How do we ensure the global, open nature of the products over time?

Systems Engineering Terminology

Issues:

- There exists specific albeit different terminology used by each domain and/or industry.
- A description may have everything to do with systems engineering but it is not easily recognizable as systems engineering when the terminology being used is non-mainstream or unfamiliar.
- Confusion and misunderstanding are associated with "______(fill in)_____ systems" engineering versus "____(fill in)___" systems engineering; that is, with the *engineering of systems* within a domain versus *systems engineering* within a domain.

Thought points:

- Should we standardize the systems engineering terminology to be accepted and used?
- Should we define certain aspects of the terminology and recognize that other terminology is equally acceptable in use?
- Should we define a body of terminology as standard and other terminology as tailorable to the topic? Or domain?
- Should we allow multiple different terminologies to be used for the same thing, perhaps providing a thesaurus for guidance?
- Should we include a 'translator' between domains as part of a definition of standard or common systems engineering terminology?

A list of main BKCASE references has been provided as a separate attachment, and we ask that you review the top six references, noted in 'red font' in the list of main references, prior to the workshop. Most of the references are available through public urls at this time and these are provided in the list. For those references that are not publicly available a url that requires a password is provided to access the documentation.

During the workshop, perhaps the most difficult personal challenge will be to keep an open mind to allow the group to build consensus for the greater good of the project. It is many times easier to identify lack of an open mind in others rather than oneself. See "An Open Way: 10 Suggestions to Talking and Listening that are Simple but Not Easy" on page 3 of this attachment of a book review for "Solving Tough Problems" by Adam Kahane: `www.bkconnection.com/static/solvingtoughPR.pdf` for some interesting guidance in this area.

So put on your thinking hats, and get prepared to come to our next workshop with an open mind and some great ideas! See you there.

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