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

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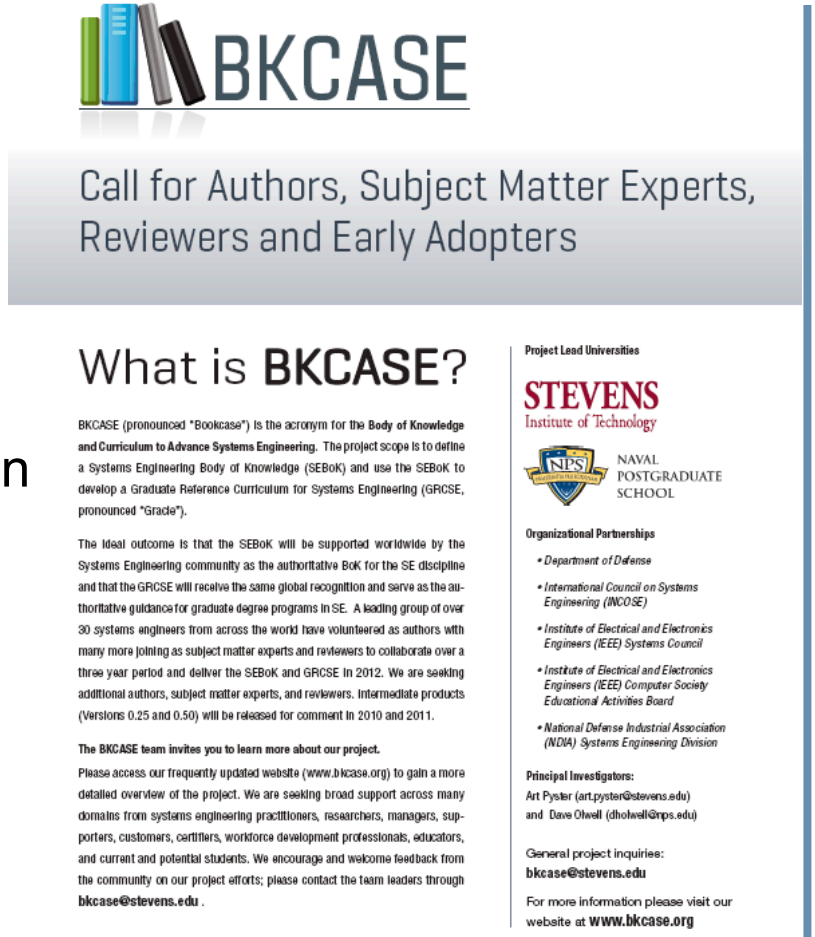
Objective

To provide a proven process for visually communicating the purpose, value proposition, strategic intent and other defining characteristics of a project to others such as new team members, customers, users and other stakeholders or interested parties.

What is BKCASE?

- Project led by Stevens Institute of Technology and Naval Postgraduate School who are creating two primary products:
  - Body of Knowledge in systems engineering (SEBoK)
  - Graduate Reference Curriculum in Systems Engineering (GRCSE)
- Started Fall 2009 and will run through Fall 2012
- Intended for world-wide use
- Not intended to be used directly for accreditation



BKCASE

Call for Authors, Subject Matter Experts, Reviewers and Early Adopters

What is **BKCASE**?

BKCASE (pronounced "Bookcase") is the acronym for the **Body of Knowledge and Curriculum to Advance Systems Engineering.** The project scope is to define a Systems Engineering Body of Knowledge (SEBoK) and use the SEBoK to develop a Graduate Reference Curriculum for Systems Engineering (GRCSE, pronounced "Gracie").

The ideal outcome is that the SEBoK will be supported worldwide by the Systems Engineering community as the authoritative BoK for the SE discipline and that the GRCSE will receive the same global recognition and serve as the authoritative guidance for graduate degree programs in SE. A leading group of over 30 systems engineers from across the world have volunteered as authors with many more joining as subject matter experts and reviewers to collaborate over a three year period and deliver the SEBoK and GRCSE in 2012. We are seeking additional authors, subject matter experts, and reviewers. Intermediate products (Versions 0.25 and 0.50) will be released for comment in 2010 and 2011.

The BKCASE team invites you to learn more about our project.

Please access our frequently updated website (www.bkcase.org) to gain a more detailed overview of the project. We are seeking broad support across many domains from systems engineering practitioners, researchers, managers, supporters, customers, certifiers, workforce development professionals, educators, and current and potential students. We encourage and welcome feedback from the community on our project efforts; please contact the team leaders through **bkcase@stevens.edu** .

Project Lead Universities

STEVENS Institute of Technology

NPS NAVAL POSTGRADUATE SCHOOL

Organizational Partnerships

- *Department of Defense*
- *International Council on Systems Engineering (INCOSE)*
- *Institute of Electrical and Electronics Engineers (IEEE) Systems Council*
- *Institute of Electrical and Electronics Engineers (IEEE) Computer Society Educational Activities Board*
- *National Defense Industrial Association (NDIA) Systems Engineering Division*

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For more information please visit our website at **www.bkcase.org**

*See bkcase.org for more info

Phase I. *Create an initial diagram from established prose*

Appendix A:

- Vision
- Objectives
- Value Proposition
- Project Strategy
- Other SEBoK Characteristics
- Other GRCSE Characteristics

BKCASE Vision and Objectives

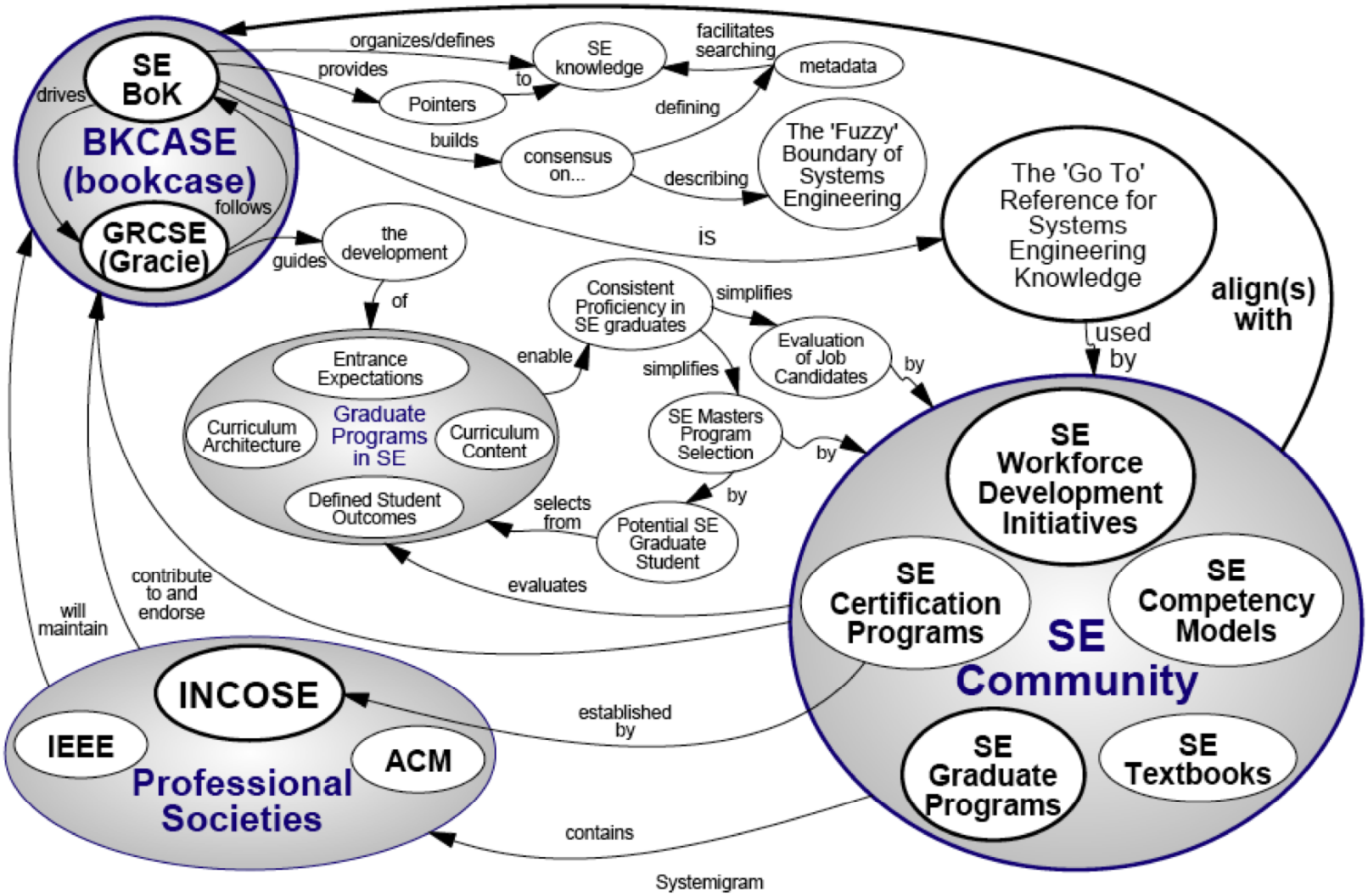
Vision

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

Objectives

1. Create a SEBoK 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 SEBoK and GRCSE.
4. Transfer stewardship of SE BoK 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.

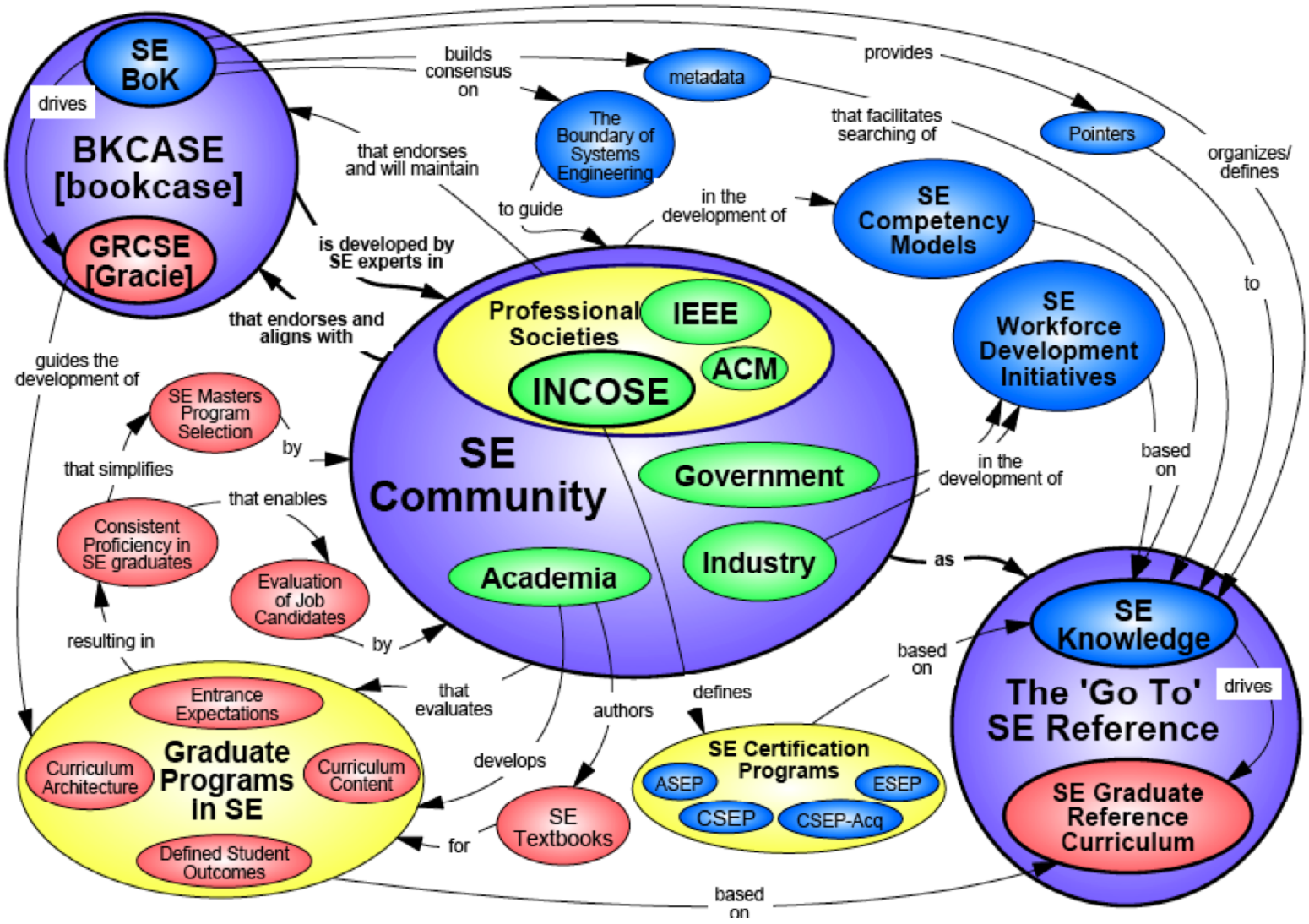
Initial Systemigram



Phase II. *Compare diagram to Systemigram rules / guidelines and update accordingly.*

- The flow from the system of interest (top left hand corner) to the mainstay (primary purpose) of the system is flowing in the ‘wrong’ direction.
- The SE Community is an important component in the description of the project, but not in and of itself the purpose of the project.
- ‘Graduate Programs’ is duplicated
- A community is not made of objects, but rather of people.
- The phrase ‘guide the development of’ calls out ‘the development’ as an important node.
- The ‘Fuzzy Boundary of Systems Engineering’ node simply ends in the middle of the diagram.

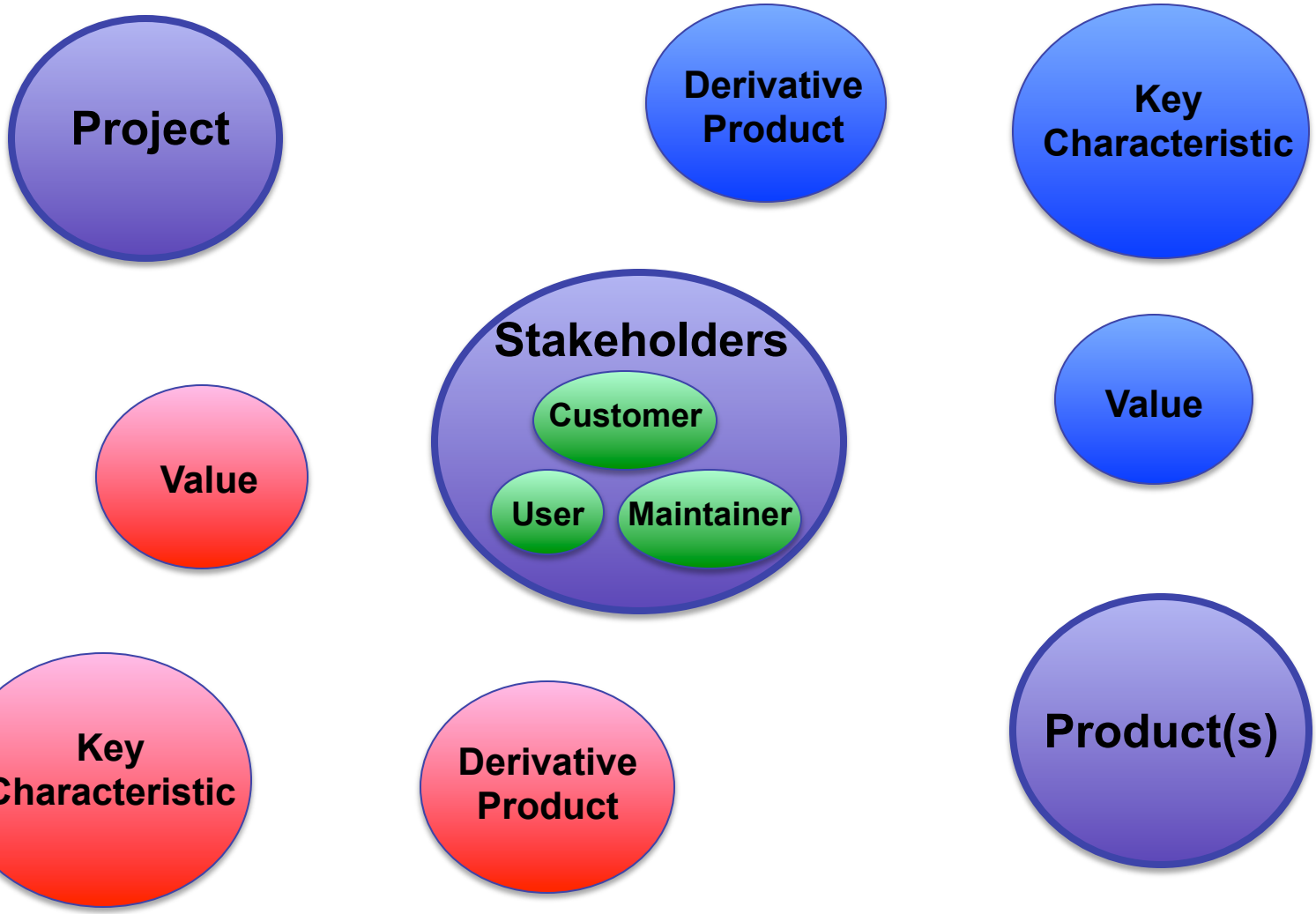
Next Iteration of Systemigram



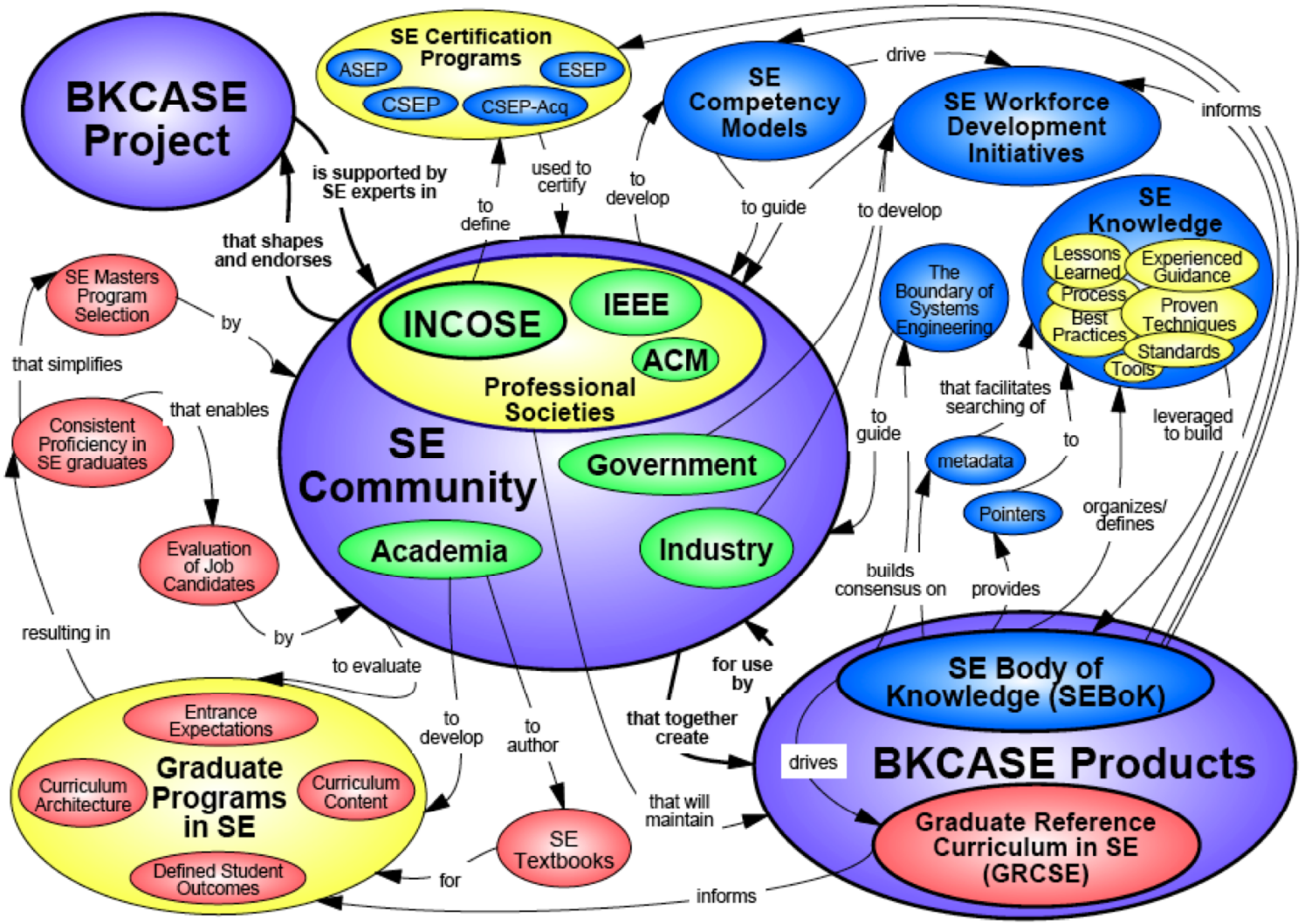
Phase III. *Present the Systemigram to the core project team and reach consensus.*

- Colors used to further aid in the understanding of the system diagram:
  - Blue used to represent nodes related to the SEBoK product.
  - Red used to represent nodes related to the GRCSE product.
  - Green represented stakeholders.
  - Purple represented the ‘mainstay’ path of the diagram.
  - Yellow was used for the other collector nodes.
- The ‘Go To’ Reference was intended as the object of the ‘purpose’ of the project but is a sync and the components therein are components of the system description but not the final products.
- Needed to show where best practices, experienced guidance, lessons learned, as well as SE related process, standards, and tools, fit into the description.

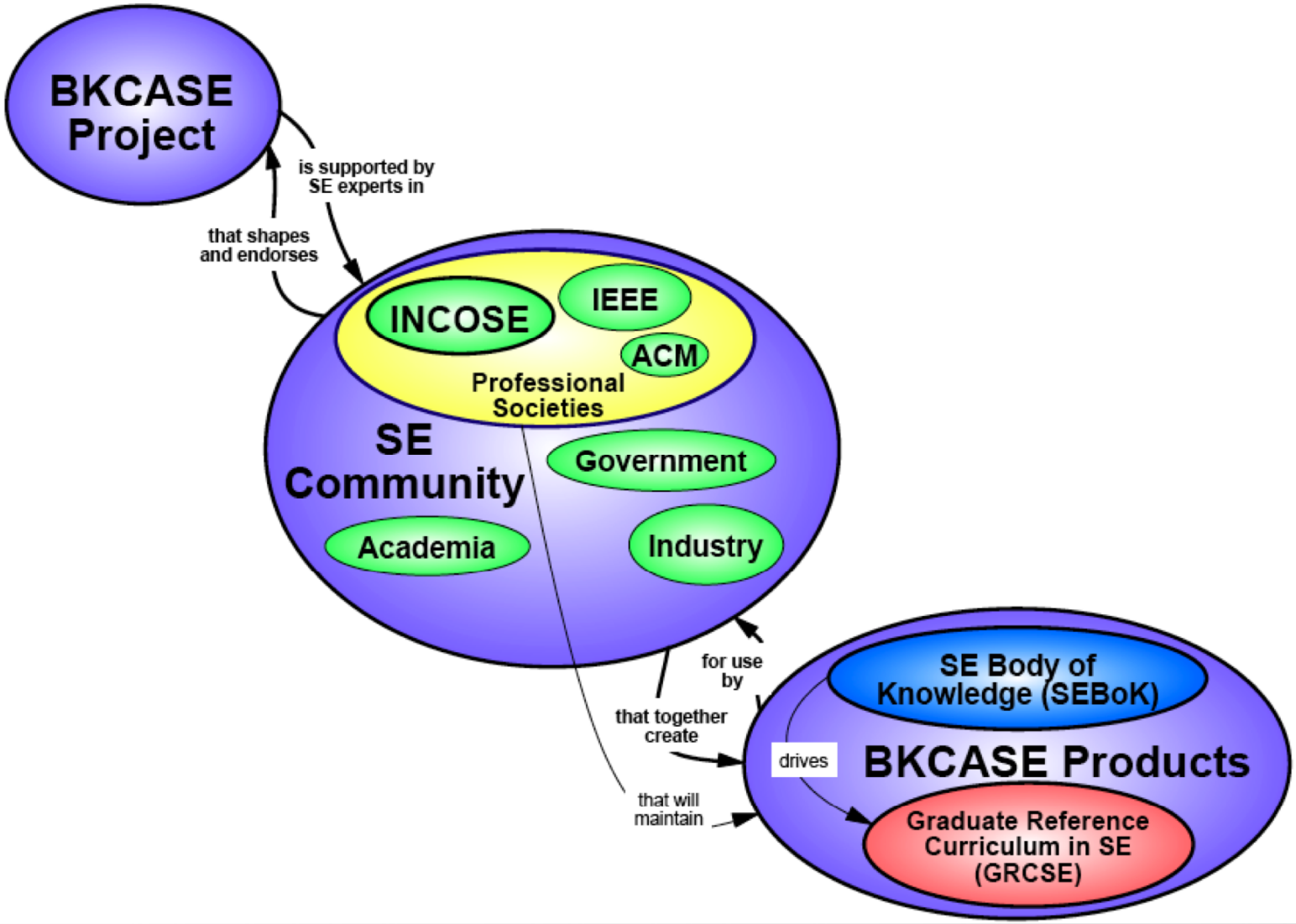
Final Concept for Visualizing Project Description



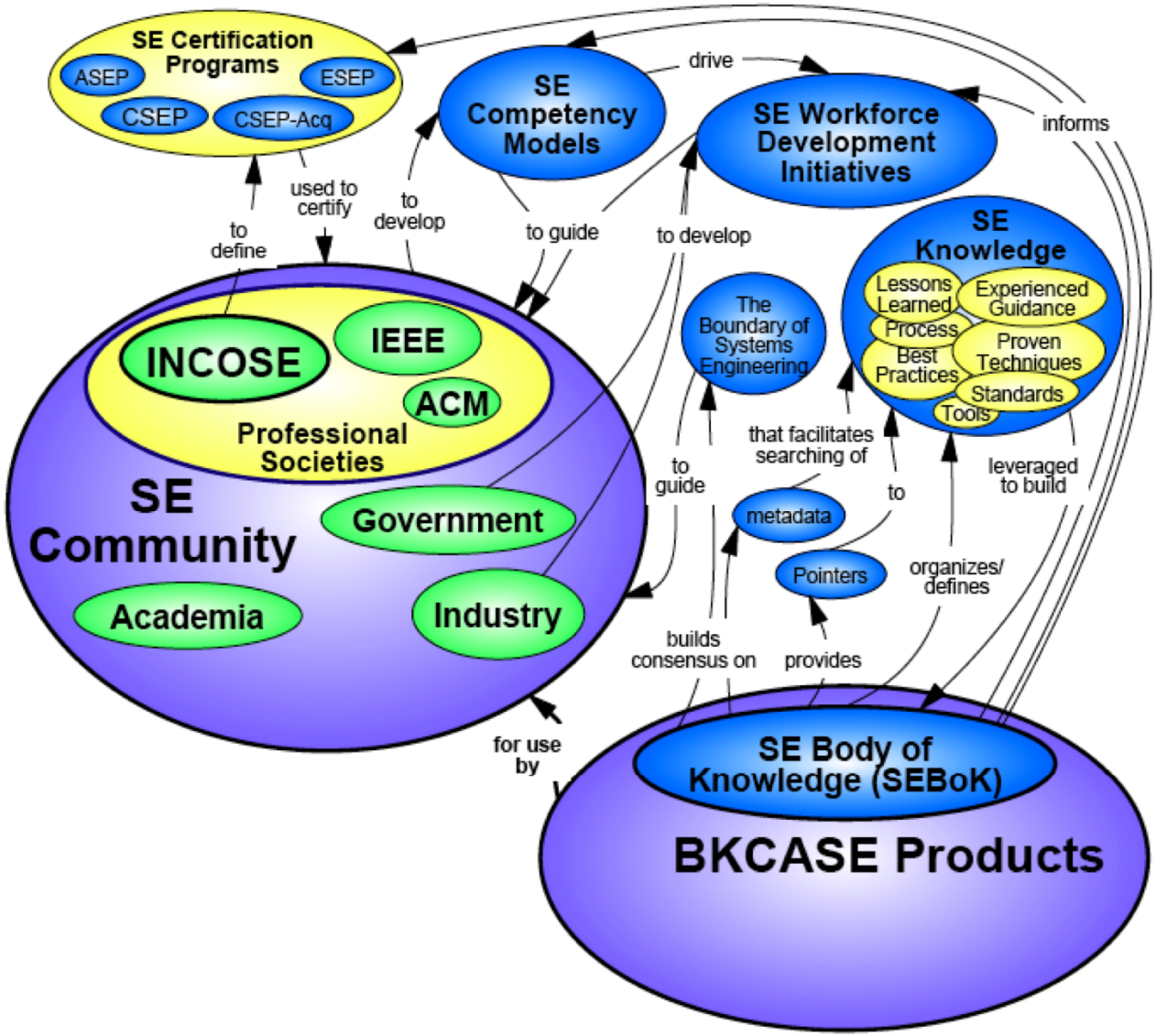
Final Systemigram



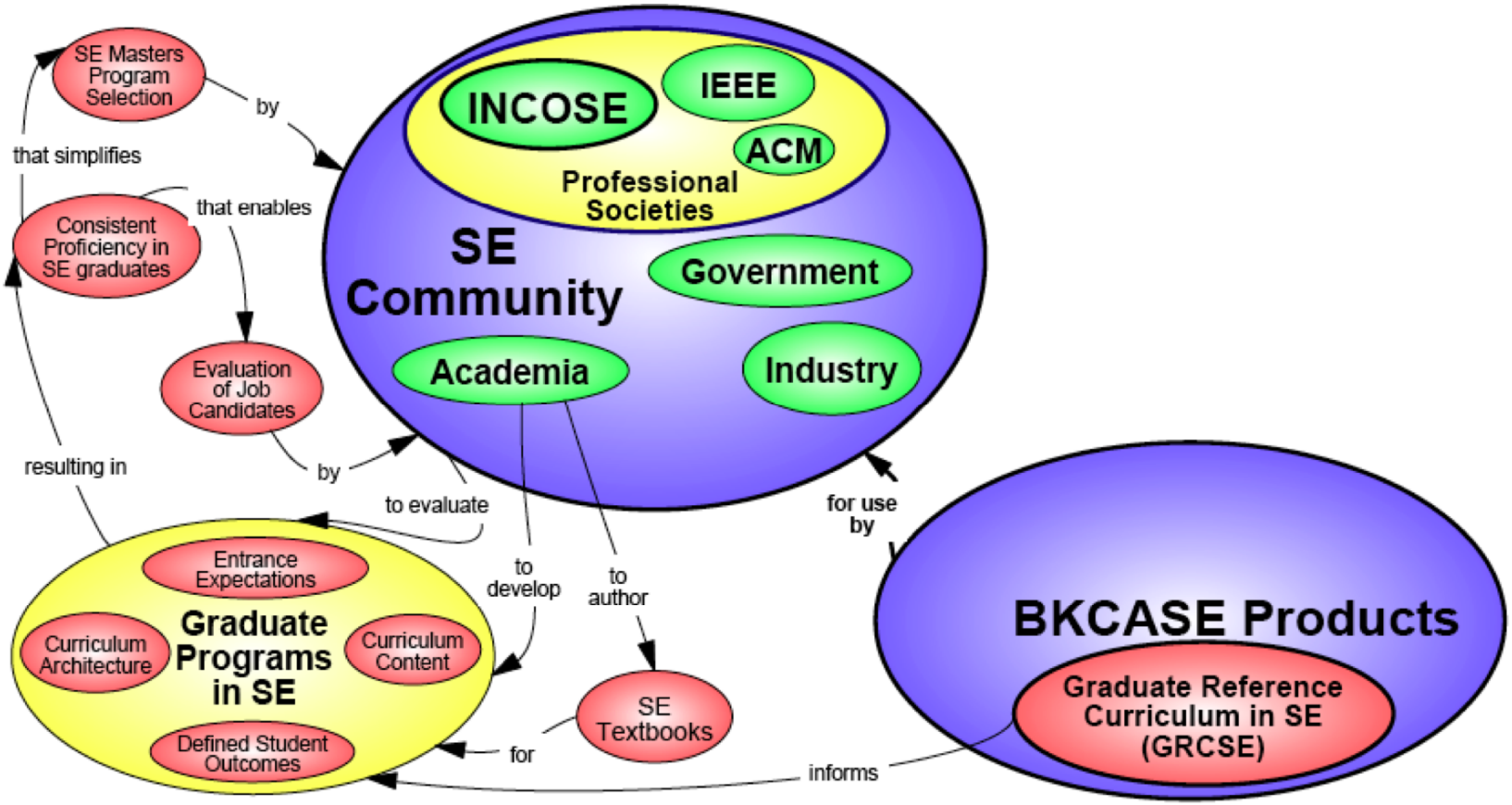
The BKCASE Mainstay



Guide to the SE Body of Knowledge



Graduate Reference Curriculum for SE



Outcomes

- Worked with customer to reach consensus on the project definition and charter and visually communicate that consensus to the community.
- Leveraged system diagram as part of project kickoff in December 2009 with growing project team with a couple dozen authors and continue to use to spread the story.
- Developed BKCASE story as recorded presentation:
  - Available at www.bkcase.org/about-bkcase/bkcase-story/
  - 153 page-views last quarter
- Project System Diagram is also part of BKCASE flyer
  - Although watch out:
    - Can be intimidating when not part of 'story'
    - Difficult to get true story from static view
  - Be sure to include link to 'story'!

Guidance for System Diagrams of Projects

- Purpose:
  - Project in upper left
  - Products in lower right
  - Stakeholders in mainstay
- Key relationships:
  - Value-add outcomes of system
  - Derivative products
  - Primary characteristics
- Be sure vision/mission, objectives, goals addressed
- Leverage rules of systemigram development
- Seek expert advice and community/customer feedback
- Use Colors Effectively
- Create a story

Thank You!

Questions?

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Backup Slides

SEBoK Value Proposition

1. 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 understanding the role of SE in projects and programs; and in defining SE products and processes. SEBOK will fill that gap, becoming the "go to" SE reference.

2. The process of creating the SEBoK will help to build community consensus on the boundaries and context of SE thinking and to use this to help understand and improve the ability of management, science and engineering disciplines to work together.

3. Having 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. Having common ways to identify metadata about SE knowledge will facilitate search and other automated actions on SE knowledge.

GRCSE Value Proposition

- There is no authoritative source to guide universities in establishing the outcomes graduating students should achieve with a master's degree in SE, nor a guidance source 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.

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Project Strategy

1. Publish incrementally/iteratively with GRCSE trailing SEBoK
2. Create common vocabulary to facilitate communications among the team
3. Throughout the project, involve professional societies to facilitate quality, acceptance, and their eventual role as stewards
4. Build early consensus and maintain it throughout the lifetime of the project
5. Rely on and include academia, industry, and government from multiple fields for authors and reviewers
6. Extensively leverage volunteer labor for both authoring and review
7. Rely on existing source material wherever possible and involve principals from efforts that created source material wherever possible
8. Leverage the processes used to create GSwE2009 and the NPS Modeling and Simulation Acquisition Curriculum
9. Keep completely open and collaborative at a global level – but authors make content decisions
10. 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
11. Keep the team focused on the value propositions when conflicts arise.

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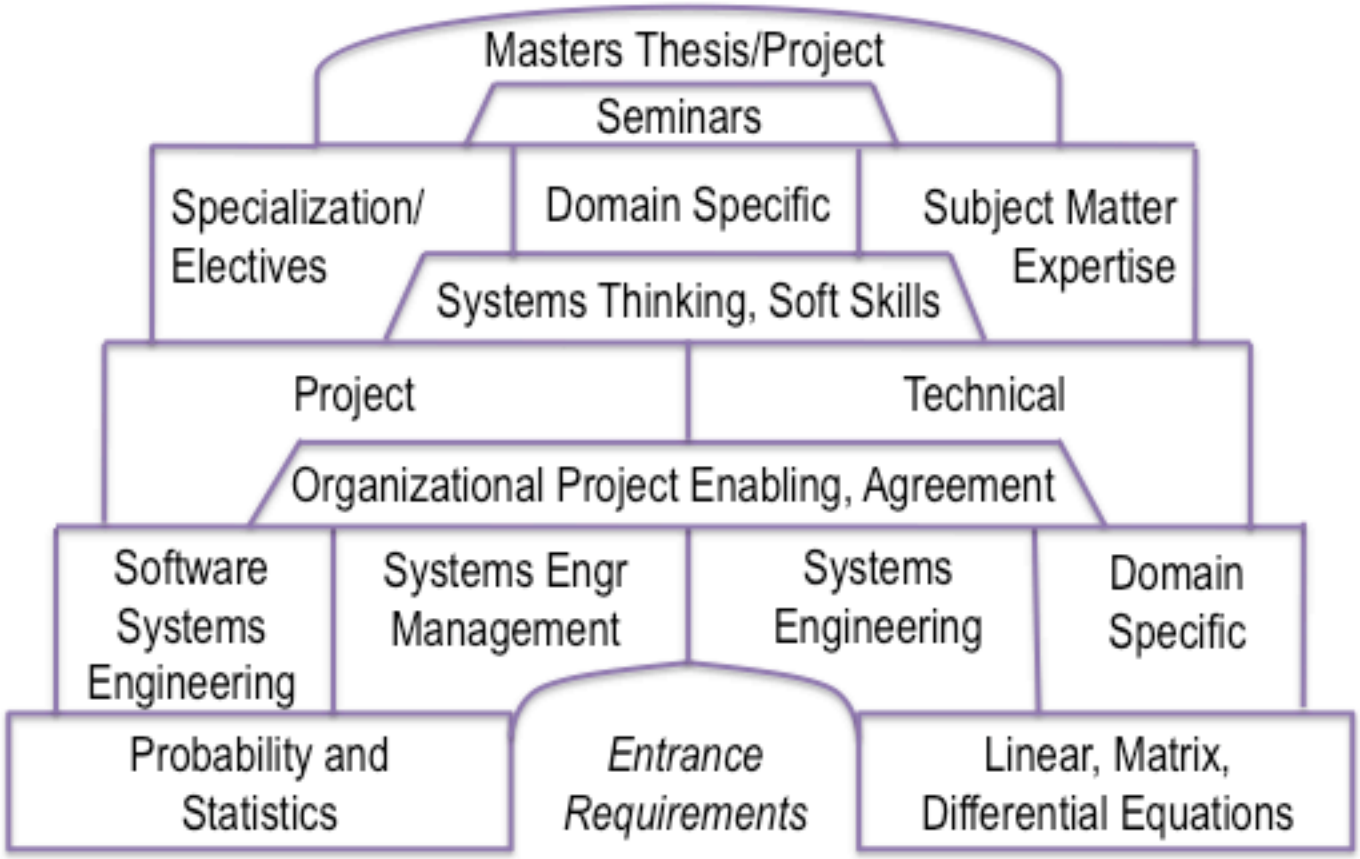
Graduate Reference Framework



Capstone

Depth and Breadth

Core: System Life Cycle Processes

Fundamentals

Pre-Requisites

References: Squires, A., & Cloutier, R. (2010). Evolving the INCOSE reference curriculum for a graduate program in systems engineering . *Systems Engineering, 13(4)*
Squires, A. & Cloutier, R. (n.d.). Evaluating the effectiveness of classroom discussion approaches used in the remote delivery of systems engineering education. In *Proceedings of the 2010 american society for engineering education (ASEE) annual conference and exposition conference, louiseville, kentucky, june 20-23, 2010.*