Building a Defense SoS SE Community: NDIA SoS Committee

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Abstract

There is increasing interest in DoD in approaches to apply systems engineering to address systems of systems (SoS). OSD has issued an initial guide for systems engineering for SoS as a starting point for DoD consideration of the SE SoS challenges and current understanding of approaches. The Army and Navy have established SoS SE organizations. And there is an increasing number of SoS initiatives in the Service and at the Joint and DoD levels.

As a result, the NDIA SE Division has formed an SoS SE committee. This committee held its kickoff meeting in April 2009 and held meetings in June and August. This presentation will describe the purpose of the committee, committee discussions to date and interests of committee members.

The presentation will focus on plans for committee activity in 2010 including a new website to support ongoing discussion and information exchange among members of the SoS SE community.

Purpose and Topics

- Purpose
  - Introduce new SoS SE Committee to SE community
  - Share current thinking about the shape and focus of SE Committee activities and plans
  - Solicit input on Committee direction
- Topics
  - Background on Committee creation
  - Committee activities and participation to date
  - "Sleepless Nights" Topics
  - Creation of 'online community'
  - Next steps

Background

- Increasing attention focused on the challenges of engineering independently useful systems to work together to meet user capability needs
    - Includes Service Oriented Architectures, Systems of Systems, Net-centric Enterprise Systems, and more

- The systems engineering community has begun to address these challenges
    - DoD Guide for Systems Engineering for SoS
    - Army SoS SE Organization

- A new committee of the NDIA SE division was proposed to address this area

SoS SE Challenges

- Many SE models are based on the ability of the systems engineer to
  - Define boundaries and requirements clearly
  - Control the development environment so that requirements can be optimally allocated to components based on technical trade analyses

- Today's defense SoS environments challenge this approach
  - Constraints to use <u>existing systems</u> as SoS components result in an extant allocation of functionality & implementation which may not be optimal
  - Component systems have <u>independent</u> ownership, funding, and development processes requiring the consideration of factors beyond the technical when evaluating capability objective options
  - Changes during development and unanticipated <u>changes or emergent behavior</u> may have an overriding effect on user capabilities, further complicating the work of the systems engineer

- These factors add complexity to both the systems and the systems engineering context

Committee Mission and Objectives

- Mission
  - To provide a forum where government, industry, and academia can share lessons learned, promote best practices, address issues, and advocate systems engineering for Systems of Systems (SoS)
    - To identify successful strategies for applying systems engineering principles to systems engineering of SoS

- Objectives
  - What does it mean to do SE in these environments?
  - What are the roles of processes, policy, guidance, and governance?
  - What is the role of SE in Capability Portfolio Management?
  - What are the architecture changes that will incorporate the SoS attributes necessary for SoS integration across the enterprise?
  - What new methods, processes and tools are needed to address the breadth, complexity of today's systems of systems?

Plan to Revisit Mission and Objective Based on Initial Committee Experience

Committee Activities

- ## April 2009- Kickoff Meeting
  - ❖ Government sponsor SoS interests and expectations
  - ❖ Background, challenges, mission and objectives of SoS Committee
  - ❖ Candidate topics discussion – "Sleepless Nights"

- ## June 2009
  - ❖ SoS SE committee plans including review of input on topics of interest
  - ❖ SoS and T&E Discussion
  - ❖ Presentation by AFEI SOA Working Group on SOA and Acquisition

- ## August 2009
  - ❖ "SoS SE Track" at the NDIA SE Conference in October
  - ❖ Update on ongoing "SoS and M&S" activity under the NDIA M&S Committee
  - ❖ "SoS and T&E", continuation of discussion from the June meeting
  - ❖ Planning for next year's committee activities

Committee Participation

- Large interest in committee participation
  - ~ 80 people have expressed interest and have participated in one or more of the meetings
  - ~ 30-40 participants at each meeting split between onsite and remote participation
  - Participants include Government, Industry, FFRDCs and Universities
- Responding to participant preferences for structuring committee operations
  - Committee plans to meet in conjunction with bimonth SE Division meetings to leverage travel
  - Remote access will be provided for regular meetings
  - Online facility (SharePoint site) has been established to facilitate continuous asynchronous exchange
- Very <u>lively</u> discussions

'Sleepless Nights' Topics

23 Sleepless Nights Topics

1. Lessons learned from past and on-going SoS programs
2. Perspective of the SoS manager for SoS SE
3. Defining SoS relationship in terms of an 'SoS Signature'
4. Relationship among SE approaches for systems, SoS, FoS
5. Difference in SoS definitions
6. Developing validated SoS policy
7. Relationship between SoS and acquisition process
8. Addressing SoS from perspective of a new system acquisition
9. Role of requirements in SoS
10. SoS architecture
11. SoS Integration
12. SoS and Complexity
13. Role of optimization in SoS SE
14. Defining and measuring SoS performance
15. SoS test and evaluation
16. SoS SE competencies and training
17. SoS governance
18. Constructive approaches to addressing politics in an SoS
19. SoS business models
20. Relationship between SoS and net-centric services
21. Science based theory to support SE of systems and SoS
22. SoS modeling and simulation
23. SoS SE Analyses of CBRN

	Below is a compendium of the SoS SE topics recommended by committee members. In the space below, please indicate your top 5 topics along with specific questions you would like the committee to address in the area.		
	Suggested Topics	**Top 5 Topics**	**Specific questions you would like to see addressed**
1	Lessons Learned from past and on-going SoS programs		
2	Perspective of the SoS manager for SoS SE		
3	Defining SoS relationship in terms of an 'SoS Signature'		
4	Relationship among SE approaches for systems, SoS, FoS		
5	Difference in SoS definitions		
6	Developing validated SoS policy		
7	Relationship between SoS and acquisition process		
8	Addressing SoS from perspective of a new system acquisition		
9	Role of requirements in SoS		
10	SoS architecture		
11	SoS Integration		
12	SoS and Complexity		
13	Role of optimization in SoS SE		
14	Defining and measuring SoS performance		
15	SoS test and evaluation		
16	SoS SE competencies and training		
17	SoS governance		
18	Constructive approaches to addressing politics in an SoS		
19	SoS business models		
20	Relationship between SoS and net-centric services / SE in Net Centric SoS		
21	Science based theory to support SE of systems and SoS		
22	SoS modeling and simulation / Representation of an SoS in Simulation Environment / Need for a valid sythentic environment for SoS		
23	SoS SE Analyses of CBRN		
24	Other		

Participants Provided Feedback On Top 5 Topics of Interest

- At the April Kickoff meeting
  - Participants were asked to share the aspects of SoS which "keep them awake at night"
- Between April and June Meetings
  - Sleepless nights topics were synthesized and topic list was circulate to participants to provide feedback on topics of specific interest
- Initial set of topics of high interest were used to set agenda for June and August meetings

Committee Interest Areas

- Areas of highest interest (14 responses)
  - SoS Test and Evaluation (8 of 12)
  - Relationship between SoS and acquisition process (7 of 12)
  - Lessons Learned from past and on-going SoS programs (6 of 12)
  - Defining and measuring SoS performance (5 of 12)
    [related questions were posed under SoS Test and Evaluation]
  - SoS modeling and simulation (5 of 12)
    [Already a topic of NDIA M&S Committee]
  - SoS architecture (4 of 12)
- Wide range of interests and lots of energy around topics
  - Very hard to address some topics in the space of a meeting
- Seeking opportunities to augment bimonthly meetings
  - NDIA SE Conference – special committee meeting and SoS SE Track
  - Online facility – SoS SE SharePoint

NDIA SE Conference
18 Presentations in the SoS SE Track (1 of 2)

Updates on DoD SoS Activities

Smith	Establishing a Departmental-Level Systems-of-Systems Engineering Management Construct for the Department of the Navy, Progress Report
Reed	Naval Systems of Systems Engineering Guidebook Update
Dahmann	DoD Systems of Systems Update

Characterizing SoS

Turner	A Distillation of Lessons Learned from Complex System of Systems Acquisitions
McGovern	Global Earth Observation System of Systems (GEOSS)
Colombi	System of Systems Challenges and Solutions: Case Study Insights

Modeling and Simulation and M&S

DeLauerntis	Dynamic Modeling of Programmatic and Systematic Interdependence for System of Systems Acquisition
Zentner	On Modeling and Simulation Methods for Capturing Emergent Behaviors for Systems of Systems
Lane	Modeling and Simulation Support for the Systems Engineering of Systems of Systems (short title "M&S Support for SoS SE")

NDIA SE Conference
18 Presentations in the SoS SE Track (1 of 2)

Engineering SoS

Simanta	Requirements Engineering for Systems of Systems
Maddry	Engineering Systems of Systems: An Integration Perspective
Sledge	Software Assurance in a System of Systems World: Interoperability Challenges - Reports from the Field
Mayoral	Extending FMECA to Systems of Systems
Anderson	Applying Readiness and Fit Analysis to Systems of Systems Environments

Extending Our Understanding of Sos

Boxer	Designing Collaborative Systems of Systems in support of Multi-sided Markets
Smith	An Introduction to Influence Maps: Foundations, Construction, and Use
Roney	Systems Engineering: Asynchronous System Integration Theory

Tools

Smith	An Introduction to Influence Maps: Foundations, Construction, and Use

NDIA SE Conference
T&E and Net-Centric Tracks

T&E Track

Potential focus topic for 2010 with T&E Committee

McDermott	Test and Evaluation in a System of Systems Environment
Rajczak	Joint Integration and Interoperability Lab (JSIIL)
Rebovich	Systems of Systems Systems Engineering and Test and Evaluation

Net-Centric Track

Way	Net-Centric Best Practices
Christman	Data sharing in a Stability Operations Community of Interest: Utilizing a pilot program to prove concepts and develop trust.
Miller	C4I Architecture for Joint ASW
Brown	Human Interoperability Enterprise and Net-Centric Operations
Butterfield	The Boeing System of Systems Engineering (SoSE) Process and Its Use in Developing Legacy-Based Net-Centric Systems of Systems
Jacques	Linking Interoperability and Measures of Effectiveness: A Method for Evaluating Architectures
Naga	Extending Net-Centric Quality of Service to Systems of Systems
Willhite	Network Enabled Weapons, A System Engineering Approach to Achieve Interoperabilty
Simanta	Testing in Service-oriented Environments

NDIA SoS SE SharePoint Site

NDIA SoS Community Share
Instructions for Requesting an Account

This is a 2-step process.

- Step 1: Request a new account.
  - Go to https://partners.mitre.org/accountsetup/new/default.html
  - Once there, you'll be required to enter information. After you've submitted the following information, your account will need to be verified by email using the security question and answer you will be asked to provide during the request process.
    - Enter your email address.
    - Create a password.
    - Enter a security question and answer (such as your mother's maiden name).
    - Fill in the name of our extranet community: NDIA SoS
    - Provide George Rebovich's email address for the Community owner: grebovic@mitre.org

- Step 2: Validate your email address with your security answer.
  - You will receive an email with a link to verify your email address. You will be asked to provide the answer to your security question. Once you have successfully done this, the registration process is complete. You will be notified by email when your account has been successfully created. (This can take up to three business days to complete).

Next Steps (1 of 2)

- Potential topics for the SoS SE Committee next year
  - Modeling and Simulation for SoS
    - Partner with M&S Committee
    - Followup to survey completed this past year
  - SoS and T&E
    - Partner with T&E Committee
    - Build on white paper discussions at June and August Meetings
    - Leverage NDIA SE Conference SoS and T&E Presentations
  - Modeling and Simulation in support of SoS and T&E
  - Role of SoS in acquisition
  - Sharing of ongoing experience with SoS SE
    - Example from discussion at August meeting was NSSO SoS activity

Next Steps

- SoS as it is addressed by other committees
  - SoS can be viewed as a cross-cutting topic across most of the other committees (such as has been the case with M&S and T&S)
  - Contacting the other committee chairs to solicit their views on
    - How SoS affects their areas
    - What topics they see from their perspective driven by SoS considerations
- Launch online discussion groups to supplement meeting based exchanges?
- We welcome
  - New participants in the committee
  - Other topics to be considered for committee attention
  - Opportunities for partnerships with other committees