EDITORIAL
EMERGING PERSPECTIVES ON SYSTEM-OF-SYSTEMS

System-of-Systems (SoS), a term coined by the U.S. Department Defense, has now made its way into the mainstream of systems engineering parlance. While no universally accepted definition of SoS exists, SoS continues to be defined by its characteristics (Maier, 1998, Sage and Cuppan, 2001). In the mean time, SoS is fueling considerable interest in the enterprise architecting, social sciences, and system sciences communities. This special issue is inspired by several emerging interest areas in SoS: (a) viewing enterprises as SoS; (b) next generation architectural tradeoffs analysis; (c) impact of dynamic optimization on shared stakeholder values; (d) Service-Oriented Architecture as a "pure example of building SoS; (e) leadership model in acquiring unprecedented SoS; and (f) the challenge of achieving systems resilience. Six papers have been selected from recognized researchers and practitioners in the transdisciplinary field of SoS.

Madni and Moini argue that viewing modern enterprises through a system-of-systems (SoS) lens can potentially introduce a fresh perspective and provide unique insights into understanding organizational and operational issues that characterize modern enterprises. They claim that, both as a modeling construct and systems abstraction, the notion of SoS is well-suited to studying both the structural and behavioral aspects of modern enterprises. Recognizing the potential synergy between these two independent disciplines while being cognizant of the limited body of knowledge in SoS theory, they present new directions based on biologically-inspired SoS research to advance the state-of-the-art in organizing, managing, and evolving enterprises.

Firesmith and Cappell present QUASAR, an innovative approach for assessing the quality of the requirements and architecture of software-intensive systems of all sizes, complexities, and levels of mission criticality. This method, which is recursively applied at all levels of the system hierarchy, provides stakeholders with timely visibility into the evolving system design. The authors discuss their successful application of the method to large-scale weapon system acquisition.

Honour and Browning extend current thinking on the value of systems engineering to the system-of-systems domain. They describe how the value of a SoS is perceived by its many stakeholders and how they "shape" the SoS in response to their perceptions. They call this behavior dynamic optimization, in which the interactions among multiple stakeholders cause the SoS value to move generally in the direction of their shared values.

Salasin and Madni describe a model-based metrics framework for evaluating Service-Oriented Architectures (SOA), the first widely applicable approach for tying together diverse "stovepipe" (or "silo") systems, and a "pure" example of how to build SoS. The authors provide exemplar metrics and measures for SOA, and discuss several approaches to quantifying and presenting metrics.

Sisti and Latimer claim that there are fundamental flaws in today's acquisition leadership and management approaches to SoS acquisition. They take a fresh look at the variables that characterize today's system acquisitions. They argue for a shared understanding of terminology as a prerequisite to establishing a common frame of reference. They present their thoughts on a leadership model for

acquiring unprecedented SoS. They argue that a successful leadership model must be based on a transdisciplinary foundation.

Jackson presents a multidisciplinary framework for achieving system resilience in the face of disasters and disruptions. The author argues that system resilience goes beyond traditional disciplines such as reliability and system safety. He uses examples of historical disaster to make his arguments. He suggests that the combination of capabilities, culture, and infrastructure provides the basis of system resilience.

This special issue has presented six emerging perspectives on SoS. Collectively, these papers have contributed to the evolving body knowledge in SoS and identified several high payoff research themes: viewing a modern enterprise as a SoS, applying a leadership model to SoS acquisition, extending architectural tradeoff analysis to SoS, developing a model-based metrics framework to evaluate SoS based on Service-Oriented Architectures, leveraging stakeholder influence in shaping an SoS, and exploiting capabilities, culture and infrastructure to achieve system resilience.

June, 2007   Azad M. Madni
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References

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