October 2010 | Volume 13 Issue 3

INCOSE
International Council on Systems Engineering

INSIGHT

A PUBLICATION OF THE INTERNATIONAL COUNCIL ON SYSTEMS ENGINEERING

What's Inside

SPECIAL FEATURE

incentive structures over time, reward results (actual success in mitigating vulnerabilities) instead of perceived promises, and place greater emphasis on trying fresh, adaptive, self-organizing, complex systems approaches. At the least, these suggestions can only do better in protecting our security and privacy long into the future. There is a possibility for synergy.

Kristen Baldwin: One potential model of controls for system-security engineering would follow the framework for information-assurance controls. The use of the controls is mandated by policy, but the actual controls and their details are managed outside of the policy so that they can be updated or manipulated more easily. The template for these controls would include rough order-of-magnitude cost estimates, conditions for applicability, and sample contract language for use in solicitations. Another method would follow the threshold/objective framework: it would require a minimum set of security practices from the masses and establish a "gold standard" for the top tier of companies. As technology and adversarial capabilities evolve, the threshold line would rise towards the objective and a new objective would be set. There must be a balance between requiring a level or type of protection without explicitly requiring an exact implementation. This is a potential area for synergy with the self-organizing approach.

Rick Dove: Robustness drives evolution, in standards as in all systems over time. This comes in the form of complexity, which brings fragility. Traditional standards evolve for robustness—bringing fragility. Nevertheless, some standards are necessary. Self-organization among system-of-system entities and components requires interoperability—common interaction protocols and methods as a minimum. To provide parity with the adversary, security will move toward self-organizing systems-of-systems architectures. This in turn requires a new approach to standards, including real-time situation-driven adaptation options for deployers; vigilance that balances evolutionary robustness versus fragility; a plug-and-play standards architecture of principle-based self-contained standards modules and interoperability rules; and designated real-time responsibilities constantly upgrading and evolving these modules, interoperability rules, and guidelines for module-assembly completeness. New standards must be light, adaptable, and evolve at the speed of need. Perhaps this requires a standard for standards, or a self-organizing standard. The current situation is in conflict.

Panel on Service Systems and Systems Sciences in the Twenty-First Century

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On 14 July at the INCOSE International Symposium in Chicago, four delegates from the International Society for the Systems Sciences described their joint research in a panel on "Service Systems and Systems Sciences in the Twenty-First Century." The format included an introductory overview, three position presentations, and a discussion.

Jennifer Wilby from the University of Hull (UK) introduced and moderated the session. Wilby posed the question, "Can we develop a science of service systems?" This question has motivated the research project that her team has jointly pursued over the past few years. According to a recent document published by the Institute for Manufacturing and IBM, "A service system can be defined as a dynamic configuration of resources (people, technology, organisations and shared information) that creates and delivers value between the provider and the customer through service" (IfM and IBM 2008). Wilby emphasized the creation of value in the interactions between parties as a complex system. The service sector has become the dominant contributor to growth in most advanced economies, with Information and Communication Technologies (ICT) capital as a new and significant factor across all member countries of the Organisation for Economic Co-operation and Development (OECD 2007).

A Cocreation Model of the Process of Service Innovation

Kyochi Kijima from the Tokyo Institute of Technology defined "service systems science" as having two meanings: (1) the science of service systems, and (2) the systems science of service. In the science of service systems, Kijima has been studying service-value cocreation phenomena amongst service-system entities. Kijima described five gaps in service quality that need to be closed: one customer gap (between the customer's expectation of service and the customer's perception of service), and four provider gaps (1) between customer expected service and provider perceptions of customer expectations, (2) between provider perceptions of customer expectations and customer-driven service design and standards, (3) between customer-driven service design and standards and service delivery, and (4) between service delivery and external communications to customers. When customers cannot clearly articulate their own expectations, the provider and customer have to collaborate to learn about expectations and a feasible level of provisioning.

The cocreation model of service innovation has two parts. The customer and provider first engage in co-experience and codefinition of a shared internal model. With that shared internal model, they can then subsequently improve or innovate their service quality through co-elevation (by each individual) and codevelopment (in the joint relation).

In the systems science of service, Kijima sees service value as social value, not just by business, but also as provided by government agencies, not-for-profit organizations, and individuals. He listed three levels of research: (1) the basic value of social infrastructure, (2) innovative service value for business, and (3) sustainable development in the global community. Systems thinking can be applied towards to cocreation of value by mutual understanding, collaboration, and learning.

Service Systems, Systems Language, and Modelling Tools

David Ing, from IBM Canada and Aalto University (Finland), approaches service systems from the perspective of offerings. Offerings are "interactions that provide benefits in the form of physical products, service and infrastructure, and interpersonal relationships," in a three-dimensional activity package of (1) physical content; (2) service content; and (3) people content (Ramírez and Wallin 2000). A distinction can be made between relations of (1) producer–product and (2) coproduction (Ackoff and Emery 1972). An offering can be categorized either as an output of coproduction, or as an input to coproduction.

As an alternative to modelling procedures within service systems, Ing proposes modelling with extensions to the language-action perspective (Winograd and Flores 1986). Obligations can be formalized as one of four types of commitments: (1) a commitment to produce a deliverable, (2) a commitment to follow a process, (3) a commitment to provide a capability, or (4) a commitment to contribute to a relationship. These commitments can be explicitly linked upstream or downstream, with impacts by the unanticipated leading to renegotiation (Ing 2008).

Models and Messes in the Sensemaking on Service Systems

Gary Metcalf from Interconnections LLC commented from his perspective as a social scientist, observing the way that systems engineers commonly approach their work. Metcalf elaborated on the spectrum of models between the highly structured and the unstructured: e.g., "wicked problems" as described by Conklin, and Rittel and Webber, or "messes" as described by Ackoff (IBM Research 2004).

Highly structured models have a high degree of quantitative or logical predictiveness, and are fundamentally closed systems (i.e., with decisions about the content to be either included or excluded). In the open systems of social systems and living systems, the world may not heed the distinctions between included and excluded, so that models have to deal with unforeseen intrusions.

While structured problems are approached with algorithms, "wicked problems" are approached with heuristics. This perspective distinguishes between people who are proficient with specific, clear, and rigourous models, and people are not strong in math and do not appreciate formulas.

Metcalf referred to two IS panels that he had attended on the prior day. The first panel, on knowledge management, revealed a breadth of opinions on ways that knowledge is shared amongst systems engineers (i.e., the design of a service system within a professional community). Some participants prioritized the need for the clarity and dissemination of knowledge as explicit artifacts, while other participants challenged the ongoing value of such an approach that would be closed to learning. The second panel, on graduate education for systems engineers, discussed clarity in expected outcomes for educational standards. While constituents such as the US Department of Defense might see predictability in human resources as desirable, the machine-like structure of input–process–output was less credible with experienced educators, who are conscious of emerging needs for ongoing learning, novelty, and innovation. Bridging the divide between the structured and unstructured will require an appreciation of ways to jointly develop better understandings across the different groups.

Discussion

Participants recognized a need to appreciate different types of models in systems engineering. There was in an interest in open and soft systems models, as the history of systems engineering in the past has generally not included human beings within the defined boundaries of systems.

In the concrete world, systems engineers generally follow a process of definition, design, and construction. In the softer aspects of a system, developing clearer definitions of goals may be a challenge. In situations where the environment is in continual change, rule-based (or legal) order may not be possible, and negotiation amongst parties might be proposed through a process of dialogue.

While capabilities to shift perspectives are desirable, audience members were unclear about whether instruction would be effective without considering the overlay on individuals with varying types of personalities and predispositions towards ambiguity. Effectiveness in systems engineering was proposed as two attributes: (1) effectiveness in artifact transformation (e.g., customer needs to requirements to architecture to integration testing), and (2) effectiveness in communication, coordination, and enabling. While a good systems engineer exhibits the first of these attributes, only a great systems engineer exhibits the second as well.

Systems modeling in a general sense could be an area of where systems engineers and systems scientists could learn together. Intuitions that social systems could be modeled with SysML would need to be further validated.

Audience members suggested that INCOSE might see itself too much as a product, and not sufficiently as a process, capability, or relationship. They were

Panel on Service Systems *continued*

encouraged by the mini-symposium with the International Society for the Systems Sciences on 16 July, and the possibility of greater collaboration at the next February's International Workshop in Phoenix.

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International Symposium 2010 Participation Highlights

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This year we celebrated INCOSE's twentieth anniversary, drawing forth new energy and innovation from existing members and attracting many new members. The event took place in Rosemont, Illinois, at the Hyatt Regency O'Hare, and the banquet was held at the Grand Ballroom of the Navy Pier in downtown Chicago. Participation peaked out at 856, including 179 new members and not counting an additional 67 guests (spouses and others). The distribution over the various registration types is shown in the figure (right).

Participants from 25 countries demonstrated the international aspect of INCOSE. The distribution per region was as follows:

Region	Percentage of participants
Northern America	78.41
Latin America and the Caribbean	0.56
Oceania	1.81
Europe	10.31
Africa	0.28
Western and Central Asia	1.67
Southern, Eastern, and Southeastern Asia	2.79
Unidentified	4.17

Thanks to everyone who helped plan, run, and participate in this year's symposium! I am already looking forward to the celebrating of the Twenty-First International Symposium next year in Denver.