Distributed Decision Making in Systems of Systems

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Research Questions

- Defining the System of Systems (SoS) problem
  - What are SoS?
  - Why are they important?
- Descriptive research
  - What is SoS architecture?
  - What is the structure of the decision-making processes that underlie SoS?
- Prescriptive research
  - How can the SoS architect use their influence to affect the structure and behavior of the SoS?
  - How can modeling aid the practitioner in understanding and managing the complex socio-technical dynamics in SoS?

Existing state of SoS literature

- Dominated by case and experience based discussion of prior and current SoS
  - Generated many useful heuristics and guidance for practitioners but lacks rigor and consistency
  (Shah, 1999; Fryntz 1998; Shah 2001; Kuei 2003)
- Modeling of SoS is an emerging field
  - How can models be used to understanding the limits of these heuristics – especially in cases where existing case literature is lacking?

Constitutional interaction

- Constituent interaction gives rise to the underlying structure from which the SoS arises
  - SoS value emerges from these interactions
  - SoS architects, by understanding these interactions, can account for, or even take advantage of, these interactions through political interventions into the constituent eco-system.

Influence as an SoS design tool

- Inter-constituent interactions can be affected by the SoS
  - Incentives make feasible otherwise infeasible value should the constituents participate
  - Penalties reduce the utility of not participating

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