

## **System of Systems Engineering Collaborators Information Exchange (SoSECIE)**

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### **Should I Stay or Should I Go? How Constituent Systems Decide to Join or Leave Constellations in Collaborative SoS**

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#### **Abstract**

A collaborative system of systems (SoS) is formed when independent organizations decide to cooperate to achieve mutual benefits, while retaining independence of their respective systems. Each constituent system (CS) of the SoS has a set of capabilities, some of which they agree to potentially use in active collaboration with others. Such an active collaboration is called a constellation and can be seen as an instantiation of the SoS which is created to provide a joint capability. Constellations are thus the working-horses of the SoS, but due to the operational independence of the CS, they have a choice whether to join a certain constellation or not. This paper discusses the reasoning and world model that is necessary for a CS to make well-informed decisions to join and leave constellations. We argue that it is necessary for the CS to understand not only the surrounding environment, but also to have models of other CS' world models as well as of their probable future actions. It must be possible to predict whether other participants will uphold their parts of the collaboration or may defect from it to join another more rewarding constellation despite the agreements made when joining the SoS. The reasoning in the paper is illustrated using examples from two different collaborative SoS in the transportation domain.

#### **Biographies**

Pontus Svenson is a senior scientist at RISE Research Institutes of Sweden. He received a PhD in Theoretical Physics in 2001 and has a 15-year background at the Swedish Defence Research Institute (FOI), where he worked on decision support, situation awareness and data fusion, mainly for military intelligence and critical infrastructure protection. His current research is focused on systems of systems engineering, and in particular on resilience and situation awareness aspects within the transportation and critical infrastructure domains. He is the author of around 100 scientific publications and a member of INCOSE.

Jakob Axelsson is professor of computer science at Mälardalen University in Sweden and senior research leader in systems-of-systems at RISE Research Institutes of Sweden. He received a PhD in computer systems in 1997, and has a background of about 15 years in industry, mainly in the automotive domain at Volvo where he was involved in research and advanced engineering in areas such as system architecture, systems engineering, and model-based development. His current research interests are focused on systems-of-systems engineering, where he is leading a number of projects in domains such as transportation and construction. He is the author of around 100 research papers. He is a member of INCOSE and has been chairman of the Swedish chapter.