Designing Collaborative Systems of Systems in support of Multi-sided Markets

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Recent studies into the operational use of a UAV system have shown that the variety of mission situations in which the UAV system was used had far exceeded those anticipated at the time it was acquired. In effect, the dimensions of the *operational* capability space had expanded beyond the particular dimensions of the capability *design* space constrained by the acquisition paradigm. Whilst this may be regarded as the benefit of network-enabled approaches, which are intended to increase the variety of ways in which capabilities can be combined to create composite capabilities within systems of systems (SoS), this raises the question of whether the engineering of SoS can be addressed adequately from within the perspective of the capability design space.

From the point of view of the supplier, one way of approaching the impact of an expanding operational capability space is to think in terms of its being multi-sided, its multiple 'sides' corresponding to the multiple ways in which a supplied system can participate in larger systems of systems. This multi-sidedness yields an additional value to that normally associated with the direct use of a system's particular capability. This additional value is associated with the system's ability to support multiple ways of being used in conjunction with other capabilities, creating a multi-sided market in which two kinds of value have to be considered.

For the supplier of a component system within the context of a SoS, "Directed" or "Acknowledged" processes for acquiring SoS establish a single customer for the performance of the component system against a particular capability requirement, so that the supplier's focus can be on the capability design space alone (referencing OSD's Systems Engineering Guide for Systems of Systems, v1.0 August 2008). But in the case of "Collaborative" SoS, no such 'top-down' requirement is established, and a community interested in the uses of the operational capabilities of the SoS (possibly a Community of Practice) has to define its requirements 'bottom-up'. In this case, the supplier of a component system faces customer requirements that must span a variety of different ways of being used operationally, making the supplier's market multi-sided. As a result, the system's supplier must approach the capability design space from the perspective of an expanding operational capability space in which two kinds of value must be generated for the customer.

The paper will outline an approach to Collaborative SoS in which the multi-sidedness of the SoS is defined in terms of its expanding operational capability space. The paper will use this approach to distinguish the two different kinds of value associated with supporting the SoS as a multi-sided market, and show how these two kinds of value impact differently on the design of its component systems.

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