OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF DEFENSE
SYSTEMS ENGINEERING

System of Systems Engineering Collaborators Information Exchange (SoSECIE)

December 15, 2015
11:00 a.m. to Noon Eastern Time

Towards Technical Reference Frameworks to Support Open System Architecture Initiatives

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Abstract

This presentation describes a method for defining technical reference frameworks (TRFs) for open system architecture (OSA) implementations. The Naval Open Systems Architecture Strategy (11 November 2012) identifies TRFs as integrated sets of modular components that define common architectures for families of related warfighting systems to support improved competition and enable enterprise reuse. The strategy further states that TRFs should be capability-based to maximize their deployment and capability insertion on multiple platforms. Our method for developing a TRF covers the four key areas presented below, which are necessary to establish a technical architecture and open business model that will enable a given system to (1) align with other systems within the TRF for their domain and/or (2) identify potential cross-domain compatibility potential for the given system.

Capability decomposition encompasses methods to elaborate system capabilities and identify candidate modules within a system architecture for open competition. For example, a missile defense system typically includes sensor, threat assessment, and weapon launch capabilities. These capabilities may be further decomposed into layers that provide the basis for a conceptual modular architecture from which the information, functional, and physical architectures that define the system implementation will flow. When performed in accordance with OSA principles, the capability decomposition process yields a loosely coupled, modular architecture with well-defined interfaces.

An open interface standard is a specification that is publicly available, has various rights to use associated with it, and may also have various properties of how it was designed (e.g., via an open standardization process). Modern system architectures are increasingly designed to share many capabilities at finer levels of granularity in DoD systems, including infrastructure capabilities, common data and domain capabilities, and external interfaces. Published open interfaces and standards have historically been defined and adopted most successfully for DoD systems at the domain-independent infrastructure capabilities layer(s). Significant benefits including cost savings can be realized by adopting common capabilities at the higher layers.

Modern design principles recommend the use of a common data model, i.e., a formalization of the semantics and structures for relevant data/information concepts that has been endorsed and adopted by the various system contributors. This model may or may not serve as an artifact for internal use by any given system in a system-of-systems (SoS), but it establishes a definitive standard that decouples the requirements and design decisions of one contributing system from the others. This decoupling is essential for modular system design and is a cornerstone of open architecture.

When creating a SoS across multiple program and system organizations, an established and recognized governance of the SoS is essential. The goal is to enforce the principles of the reference architecture and associated data model so that all of the benefits of that architecture are realized by the participants. In addition to methods and guidelines for developing the foregoing TRF elements, examples of DoD system implementations in accordance with OSA principles are provided.

Biography

Douglas Schmidt is a Principal Researcher for the Software Engineering Institute. He has published 10 books and more than 500 technical papers on patterns, optimization techniques, and empirical analyses of frameworks and domain-specific modeling environments that facilitate the development of middleware for mission-critical applications.