Promises, Expectations, and Realities of Interoperability: from COTS to Systems of Systems

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Abstract

Commercial and government organizations are increasingly dependent on multiple systems that will operate seamlessly together both within their own enterprise as well as across organizational boundaries. Defining, building, fielding, and evolving these “systems of systems” is sufficiently different from traditional single system development that changes to engineering, management, and organizational practices is necessary. This tutorial explores the differences of systems of systems and leverage applicable lessons from acquiring, fielding, evolving COTS-based systems.

1. Tutorial description

There is an increasing demand for greater interaction and communication among software-intensive systems. Commercial organizations are increasingly dependent on multiple systems to operate seamlessly both within their own enterprise as well as across organizational boundaries of their various suppliers. Within the public sector, government agencies at multiple levels are finding that their systems must now interoperate to effectively cope with integrated services such as emergency management response or law enforcement. Military organizations must operate across international boundaries for effective mission planning and execution. These business and government needs are driving organizations to build, field, operate, support, and evolve systems that are expected to interoperate with others systems successfully – as “systems of systems”.

We are entering a world where the systems we build and evolve are often constituents in larger systems of systems, where the individual systems are independently developed, managed, and evolved. This scenario evokes interesting parallels to the world of COTS-based systems, where COTS products are independently developed, managed, and evolved by their respective COTS vendor.

We found that the techniques and practices for defining, building, fielding, and evolving COTS-based systems were often at odds with practices for custom built systems. New or adapted practices for acquiring, managing, and construction COTS-based systems were necessary. As we move into the world of systems-of-system, our experience is indicating a similar need. What are those differences? Are there concepts and practices that we can leverage from the COTS-based system community?

This tutorial presents an overview of the relevant differences between single systems (custom and COTS-based) and systems-of-systems, and shows how these differences necessitate new practices. We explore the implications for a number of common management and engineering activities along with some emerging approaches using examples from actual projects and a short exercise.

2. Target audience

This tutorial is appropriate for anyone contemplating or currently involved in the use of systems of systems or the interoperation of multiple systems either within a single enterprise or across multiple organizations. The tutorial discusses areas relevant to program or project managers, architects, developers, business analysts, or acquirers.

3. Learning objectives

This tutorial provides participants with an opportunity to better understand the important characteristics of systems of systems and how those impact management, engineering, and operational practices. In addition, participants will see how lessons learned from the COTS community may provide insights into the world of system of system practices.