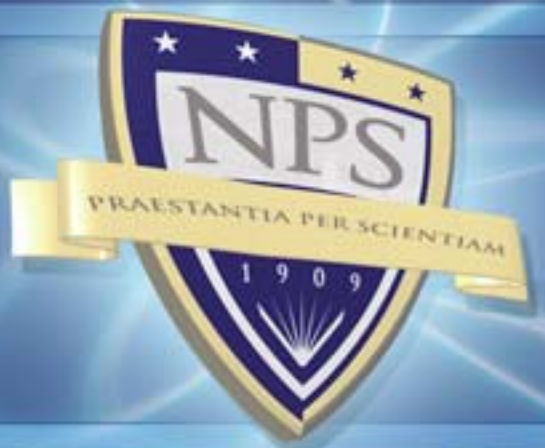

Acquisition Research Program:
Creating Synergy for Informed Change

Implementing Open Architecture

Dr. Tom Huynh

Naval Postgraduate School

Agenda

- Summary of Presentations
- OA Implementation Challenges

Modular Open Systems Approach

- Modular Open Systems Approach (MOSA)
  - DoD implementation of open systems
  - Integrated business and engineering strategy
- Drivers of MOSA
  - Access to latest technologies and products
  - Facilitation of affordable and supportable system development & modernization of fielded assets
- MOSA implementation plan
  - Incorporation of MOSA into
    - Program's overall acquisition process and strategies for acquisition
    - Technology development,
    - Systems integration (T&E included)
  - Integrated methodology to analyze, develop, and implement a system or a system-of-systems architecture
  - Program plan to monitor and assess MOSA implementation progress & to ensure system openness
- MOSA effectiveness largely affected by sound systems engineering process (Azani 2001)

Research Objective & Focus

- Assessment of MOSA implementation of Navy acquisition programs
  - Use of Naval Enterprise Open Architecture Assessment Tool (OAAT)
    - Objective and evidence-based assessment of openness w.r.t. business and technical criteria
    - Use of Open Architecture Maturity Matrix (Programmatic Level vs. Technical Level)
  - Assessment of consistency of MOSA compliance (i.e., openness)
- Analysis of assessment results obtained with Open Architecture Assessment Tool (OAAT)

***Software Architecture: Managing Design for Achieving Warfighter Capability* – Naegle**

Paper Objective & Focus

- Emphasis on requirements for SW
- Requirements developed using QAW and ATAM
- Software Engineering Institute's Quality Attribute Workshop (QAW)
  - Requirements elicitation before contracting
- Architecture Tradeoff Analysis Methodology (ATAM)
  - Operational context through scenario and test-case development before design
- Maintainability, Upgradeability, Interoperability/Interfaces, Reliability, and Safety/Security (MUIRS)
  - "Whats"—or at least a significant portion
  - Capture software performance requirements
  - Capturing and conveying OA needs
    - Maintainability, Upgradeability, and Interoperability/Interfaces
    - Safety and security considerations
    - Long-term supportability

Paper Objectives & Focus

- Objectives
  - To explore and demonstrate new approaches to quality assurance and testing
    - Better suited for providing affordable reliability in open architecture
  - To provide a new paradigm for test and evaluation
- Focus
  - Open-architecture framework for developing joint interoperable systems
    - Exploiting & adapting open-system design principles and architectures
  - Practical ways to achieve dependability in software-intensive systems with many possible configurations
    - Actual configuration subject to frequent and possibly rapid change
    - Variable and unpredictable environment of typical reusable subsystems

Approach

- Predict future needs
- Limit allowed configurations accordingly
  - Minimal impact on current development processes and organizations
  - Testing proportional to the number of reconfigurations
- Supposedly inexpensive and agile "plug and fight" process

OA Implementation Challenges (1)

- An OS strategy is an integrated business approach and design method that relies on *sound systems engineering processes* and continuing market research to evaluate alternative concepts and if appropriate, develop systems architectures based on modularity principles and well defined and widely used consensus-based interface standards, protocols, languages, and data formats.
  - **Sound systems engineering processes to develop OS**
  - **Integration challenges**
- Navy's Open Architecture vision, "plug and fight", is supposed to be inexpensive and agile.
  - **SE process to support "plug and fight"**

OA Implementation Challenges (2)

- SE integrated in acquisition
  - SE integrated in acquisition of closed systems acquisition still in the works
  - Challenges in SE integrated in open systems acquisition
- An OS strategy is usually implemented by an Integrated Product Team (IPT)
  - Product team composition
  - Authority and responsibility of IPT
- Shift is required from scenario-based testing to architecture-based testing
  - *Can architectures be independent from scenarios and missions?*

OA Implementation Challenges (3)

- Slow application of OS within government institutions is caused by bureaucratic structures, inflexible cultures, and global lacking potential body of knowledge on OS.
  - Are there other reasons that prevent successful OS implementation?
- Openness testing is not for the sake of testing. Cost must be weighed in against openness.
  - Tradeoff between openness and performance
  - How are the OAAT assessment results correlated with the performance of the open systems?

OA Implementation Challenges (4)

- Develop modular open architectures that conform to standards adopted by recognized standards organizations, or when not effective, to de facto standards.
  - **An area of great difficulty in particular to SoS architectures, when, whereas methods to develop and analyze SoS architectures exist, there is no such standardized method**
  - **Standards are not the only thing one worries about when dealing with SoS**
- Other issues
  - **Do we have a comprehensive OS that includes all the elements?**
  - **Do we have a method or approach to evolve current system into open systems?**
  - **Do we have need to make all systems open systems?**
  - **Do we have a reference model for developing OS? (Like OSI/ISO)**

Bio

Dr. Tom Huynh is an associate professor of systems engineering at the Naval Postgraduate School in Monterey, CA. His research interests include uncertainty management in systems engineering, complex systems and complexity theory, system scaling, simulation-based acquisition, system-of-systems engineering methodology, and methodology for SoS architecture analysis. Prior to joining the Naval Postgraduate School, Dr. Huynh was a Fellow at the Lockheed Martin Advanced Technology Center. He was also a lecturer in the Mathematics department at San Jose State University. Dr. Huynh obtained simultaneously a B.S. in Chemical Engineering and a B.A. in Applied Mathematics from UC Berkeley and an M.S. and a Ph.D. in Physics from UCLA.