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MOSA Implementation Challenges & Opportunities

Summary Brief of Successor Report to the NDIA SE Architecture Committee White Paper Entitled "MOSA Considerations Impacting Both Acquirer and Supplier Adoption"

Overview

- Paper covers three themes (Defense Industrial Base Perspective):
  - Integrating government and industry interests and efforts
  - Managing the concerns and related risks of contractors and suppliers involved in MOSA solutions
  - Soliciting and selecting MOSA contract partners
- National Defense Industrial Association (NDIA) System Architecture Committee Engagements
  - MOSA Initial Study and Recommendations in White Paper #1 (July 2020)
  - MOSA Information Needs and Metrics in White Paper #2 (October 2023)
  - MOSA Implementation Challenges and Opportunities in White Paper #3 (October 2023) – This Presentation

Other Collaborations:

- NDIA IP Working group, Submission to DFARS Case 2021-D005 proposed rulemaking on MOSA.
  - NDIA Comments on Defense Federal Acquisition Regulation Supplement Modular Open Systems Approaches (DFARS Case 2021-D005)
- OMG MBAcq User Community: Broad Gov and Industry base working together to Standardize the approach for using patterns, reference architectures and role-based guidance to support Model-based Acquisition
- NDIA thanks Ms. Nadine Geier, OUSD(R&E) SE&A Director, Systems Engineering, and her staff for their support of this effort

MOSA Implementation Challenges & Opportunities White Paper

- Intended Audience:
  - Stakeholders of MOSA-involved solutions who specify, select, and accept MOSA features
  - All of the DoD and services acquisition community along with members of the defense industrial base's contracting community
- MOSA Implementations: Provide unique opportunities and special considerations for contractors, suppliers, or anyone involved in the supply chain of a defense acquisition program

1. Integrating Government and Industry MOSA Efforts

Necessitates:

1) shifting of business models to align with the new realities of MOSA (vision and benefits)

2) additional alignment of government and industry objectives to the greatest extent possible and allowable under law

A balanced and fair approach to maintain a healthy Defense Industrial Base

1.1 Strategic Supply-Side Business Decisions involving MOSA

- Both government (Acquirers) and industry (Suppliers) benefit when modularity decisions align to industry Product Line Approaches (PLAs).
  - + When they do align, lower costs and reduced cycle times can result.
  - - When they do not align, then industry needs to re-create their deliverable configuration items at added cost.
- Contractor/supplier interactions need compatibility between digital engineering environments to facilitate the delivery of contractually required artifacts associated with the MOSA acquisition strategy for a program.
- With considerations for intellectual property and data rights, care must be taken to protect detailed methods and inherent assets used by industry members for competitive advantage.
- For situations with Commercial Off-the-Shelf (COTS) implementations, design changes may trigger substantial regression testing or even recertification of the base platform, thus negating many projected benefits from a MOSA-related design.

Gov & Industry modularity alignment and open communications

1.2 MOSA Implementation Success Depends on Compatibility with System Hierarchy and Architecture

- Important to identify interface points which support the optimum receipt of intended benefit(s)
- Define WBS products which are being competed where technical refresh will occur and cost savings/avoidance will be measured.
- Taxonomy is directly related to the DoD-mandated "product-oriented" work breakdown structure (WBS) of MIL-STD-881D as referenced in the *Modular Open System Architecture Considerations Impacting Both Acquirer and Supplier Adoption* white paper published by NDIA in July 2020
- MIL-STD-881 provides the language to discuss the level of detail involving a MOSA solution as the design partitions unfold. History is recorded of partitions made in the past regarding which partitions were made.
- Model-Based Acquisition standardization used to communicate clearly with suppliers utilizing patterns, reference architectures and Domain Overlays to communicate evaluation criteria including MOSA & IP requirements

Clear delineation of competed products, outcomes and measurements

1.3 Software-Specific Considerations

- Software modularity emphasizes separating functionality
  - Yields independent, interchangeable modules
  - Can be organized into common software libraries
- Software modularity imparts more responsibility in managing the functional configurations and baselines of the functional modules
- Functional Modules individually and collectively implement the system behavior and produce the associated data

Understanding the development and maintenance process

1.4 Risks to Standardization Over the System's Life Cycle

- Configuration management of interfaces, and the ownership of the technical baseline(s) which may be possibly spread across different stakeholders, are critical areas of importance.
- Diversity of participants involved across the system's life cycle introduces risks of diverging from the standard interfaces, originally established by a MOSA implementation, but that have evolved across various implementations and levels of design.
- Vital that stakeholders continue to be apprised of changes to software and hardware components throughout the system's life cycle.

Technical baseline configuration management clearly defined

1.5 Integrating Requirements Involving MOSA

- Treat MOSA Benefits as capabilities needs in the System Engineering Process
- MOSA requirements are derived from MOSA benefit objectives
- As with any other technical requirement, allocate MOSA technical requirements and interfaces to the architecture and design
- Through the course of technical reviews, MOSA success may be verified and validated at each technical baseline

Assimilate MOSA relevant requirements into design specification

2 Concerns and Related Risks of Contractors/Suppliers in a MOSA-involved Solution

- Industry is keenly interested and concerned with regard to how information and data are:
  - Identified
  - Sourced
  - Adjudicated
  - Owned
  - Managed and
  - Disposed of in the future
  - *(i.e., the Complete System Life Cycle)*

2.1 System data, intellectual property, configuration curation, and associated rights

- A modular common library for new competitions will allow the MOSA implementation by offerors to be part of the competition evaluation.
- MOSA Common Library - Integrator/prime contractor of individual platform would typically host this library. At a higher level of integration, a modular library (which would be relevant across platforms) would need to be hosted by the service.
- Contractors and product owners need to declare to what level they will maintain configuration control.

Data Management and Trust is Key

2.2 Hardware Architecture/Design Considerations with MOSA

- Using generally accepted and widely used open standards, architecture and design considerations can be done independent of specific hardware, software, and allocation decisions regarding the configuration items determined for a MOSA acquisition
- By employing a modularity approach that only constrains functional boundaries, industry is free to determine the best mix of hardware and software for that solution, which allows a different, competing solution to be replaceable without expensive initial re-integration costs.
- Modularity is a key factor in a supplier's approach to design for manufacturing, design for assembly, and continued supply chain competition. (e.g., reduced touch labor hours, competition savings, etc.)
- With a MOSA acquisition connected to a well-established modularity decision, competition is more like re-installation, not re-integration.

MOSA must still promote Innovation and Design Flexibility

2.3 Software Architecture/Design Considerations with MOSA

- Software modularity necessitates considerations not only for the resultant end product but also the frameworks, languages, and processes used for establishing, maturing, and maintaining the design.
- General considerations for MOSA in software involve a software architectural lexicon and/or reference architecture that portrays the various levels of software decomposition needed through the course of enabling system functionality and behavior.
- A software taxonomy similar to MIL-STD-881D (other than current CPCI treatment) can be used to guide development of software MOSA, with particular focus on modularity in software and standard interfaces.
- Using the reference architecture, a data model may be identified at varying levels of fidelity, including applicability of various partitions in the various DoD Domains.
- Critical to the interests of acquirers and suppliers alike, modular software data rights should be declared at appropriate levels of modular abstraction/reification (OS vs. enterprise services and similar building blocks; i.e., modular services, libraries, and applications).

Clear MOSA boundaries at appropriate architectural level of abstraction

2.4 Life Cycle Support and Maintenance Considerations

- The MOSA implementation strategy, combined with design for maintainability, should manage design choices that impact supportability
- Design choices impact:
  - Logistics Footprint
  - Reliability & Maintainability,
  - Obsolescence Management,
  - Technology Refresh
  - Mods & Upgrades Planning, and
  - Usage in Various Operating Environments
- Digital design models and design data created and maintained during MOSA-involved developments (or otherwise) can consequently be re-used during the sustainment phase of a system's life cycle for analyzing hardware and software element improvements.
- Digital Engineering with MOSA could be enhanced via "S-Series" Specifications

MOSA strategy should address Sustainment where significant Lifecycle savings can be realized

2.5 Cybersecurity Considerations in a MOSA Solution

- Cybersecurity can be a challenge in a MOSA solution from a software perspective.
- A novel approach to software cybersecurity with MOSA leverages:
  - the features of a lifecycle DevSecOps toolchain
  - prescriptive open standards for integration (e.g., FACE or OMS), and
  - Agile methods, such as Continuous Integration/ Continuous Development (CI/CD) and containers

2.6 Costs, Technical and Schedule Impacts Associated with Incorporating MOSA into Existing Products

- When Commercial Off-the-Shelf (COTS) components or existing systems have planned adaptations for MOSA-based features, it is imperative that the risks with using or modifying the existing products are adequately understood first.
- Industry recommends the use of business case analysis in determining whether, and to what extent, to apply MOSA requirements to commercial products.
- Potential product risk factors include:
  1. Effects of rapid and asynchronous changes
  2. Technology obsolescence
  3. Proprietary data
  4. Higher life cycle costs
  5. Multiple configurations
  6. Different quality practices
  7. “As is” configuration constraints
  8. Commercial standards limitations
  9. Time-limited manufacturing support, and
  10. Information security susceptibility.

Utilized Request for Information (RFI) and Draft (RFP) for industry feedback

3 Solicitating and Selecting MOSA Contract Partners

- Industry needs to know:
  - Government's MOSA vision and roadmap both Near/Long-Term Objectives
  - What external dependencies are in the expected MOSA implementation, and
  - What the minimum viable content is that's acceptable in the MOSA solution
- Instructions to offerors should include the assigned value for the Modular Open Systems Approach requested in the solicitation.
- Proposed solutions should be evaluated in the context of the ability, risks, and opportunities for achieving the desired MOSA benefits through architectural attributes such as:
  - Responsiveness, Scalability, Modularity, Availability, Affordability, and Functionality

Communication, Communication, Communication!

3.1 Flowing MOSA Requirements Down to Suppliers

- Industry has mechanisms in place to work with their supply bases.
- Business mechanisms will follow best practices with MOSA concerns related to exposing interface boundaries and providing solutions that do not rely on producer-unique development tools or proprietary approaches (e.g., those needed to enable exposed interfaces).
- The Modeling Conventions for both hardware and software need to instruct the suppliers on what and how to provide content to the acquirer
- Content may include modeling elements such as:
    1. Patterns
    2. Domain Overlay (DO) Profiles for compliance criteria
    3. Interface Definitions
    4. Analysis Definitions
    5. Templates & Schemas
    6. Evaluation Criteria & Scoring
    7. CDRLs and DIDs for Document Generation from Models
    8. Requirements Schemas

Digital Engineering, Model-based Acquisition and Architecture models can help

3.2 Defining/Executing Statements of Work Involving MOSA

- A Statement of Work that includes MOSA implementation considerations must also accommodate the appropriate MOSA specifications and standards along with the expected measures and controls for the program.

3.3 Evaluation of a MOSA Solution

- As stated in the NDIA white paper:
  - modularity and compliance of a modular design to requirements primarily involve technology evaluation while
  - openness and compliance of an open design to requirements largely involve business-related decisions and the evidence thereof
- Specific metrics needed for a given use case will depend on
  - Primary stakeholder's MOSA strategy
  - Benefits that are desired or expected to be received from the MOSA implementation.
- Evaluation of the goodness of the architecture to meet the objectives MOSA:
  - may be on a pass/fail basis,
  - unless a specific MOSA strategy is being evaluated with appropriate mechanisms in place (e.g., a WBS exists, desired MOSA features identified, etc.)
- Evaluation of MOSA needs to award value to the MOSA implementation on proposals (Section M of a proposal)

What gets measured, analzed and acted on, gets done!

Summary

- Best Outcomes Achieved when Government's MOSA Strategy and Intended Benefits Align with Industry Capabilities
- MOSA-Involved Solutions Necessitate Sensitivity to Balance of Technical Objectives and Business Realities
- Optimal MOSA Contract Partner Solicitations when MOSA Addressed in Context of Over-All Program Expectations

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