Best Practices for the Architecture, Design, and Modernization of Defense Models and Simulations

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Outline

- **Overview**
  - What the DMSRA is and isn't
  - Goals/Vision/Motivation
  - Composable simulation architecture
- **Challenges**
  - Architectural and engineering
  - Enterprise-wide interoperability and reuse
- **Best practices (patterns)**
  - Identified
  - Planned additions
- **Conclusions**

Overview

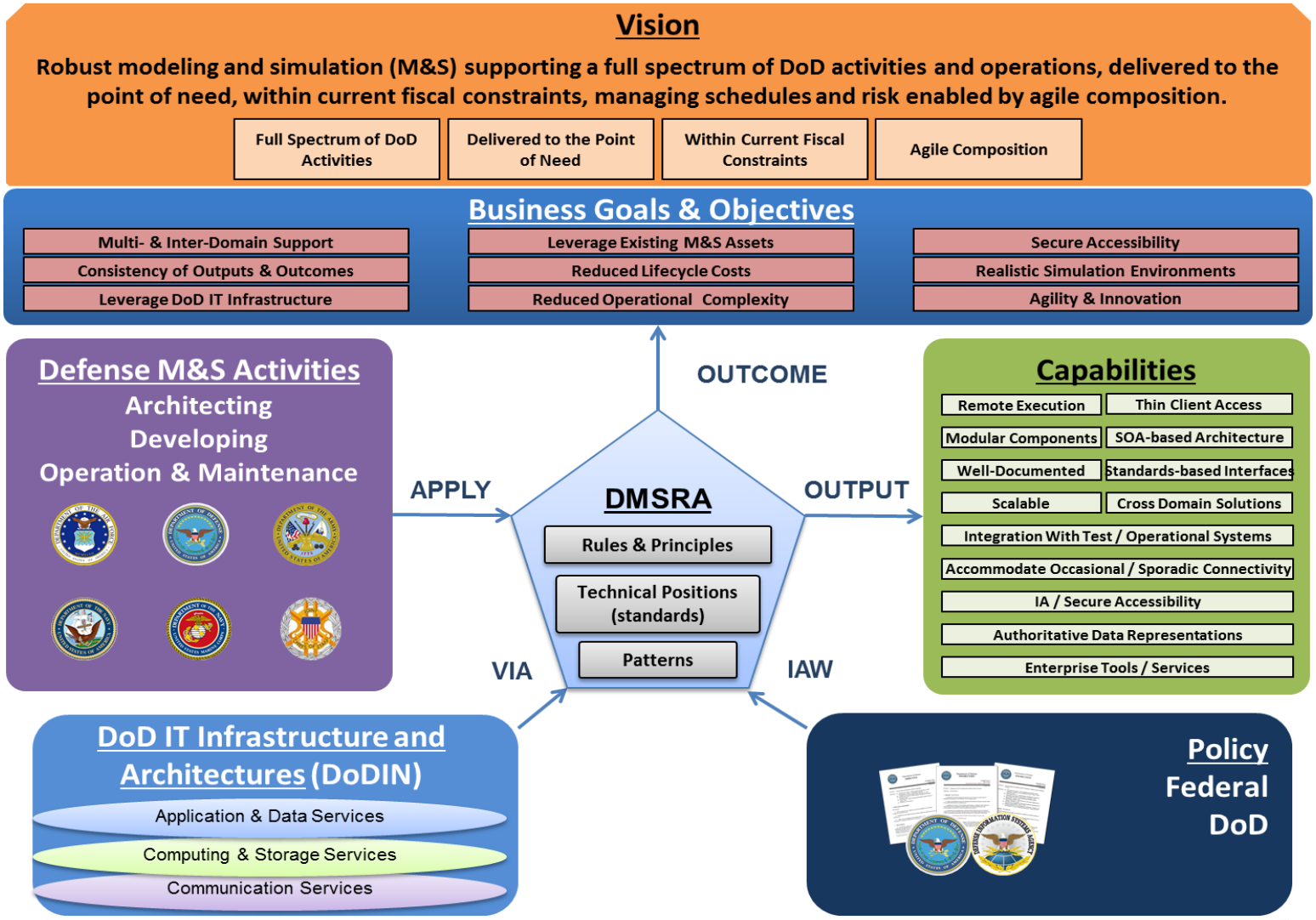
- **The DMSRA is NOT a solution architecture.**
- **It establishes a vision for Defense M&S:**
  - that leverages emerging technologies, and enterprise services;
  - to promote reuse and interoperability.
- **The DMSRA provides broadly applicable guidance.**
  - It captures principles, standards, and best practices for simulation architects and engineers to align on the vision.
  - It is not mandatory.

DMSRA Vision

A robust modeling and simulation (M&S) capability that supports a full spectrum of DoD activities and operations, delivered to the point of need, within current fiscal constraints, managing schedules and risk enabled by agile composition.

- **Models and simulations that:**
  - Are modular – decomposed into loosely coupled reusable components;
  - Execute in the cloud (where practical) – hosted in the cloud, and are capable of taking advantage of cloud characteristics such as remote access and scalability;
  - Adhere to enterprise-wide composability standards – follow standards that facilitate the reusability of components across programs and Components.

OV-1 High Level Operational Concept Graphic



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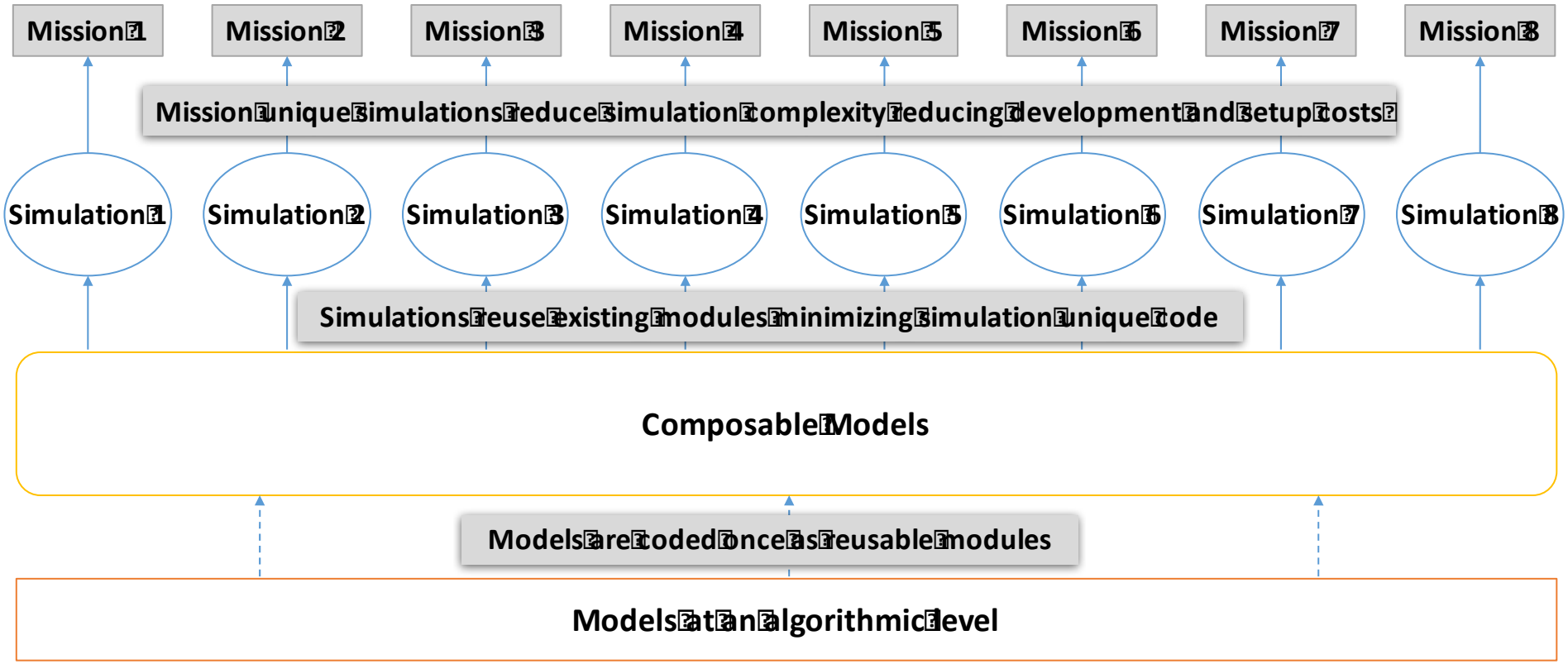
Composable Enterprise Architecture (EA)



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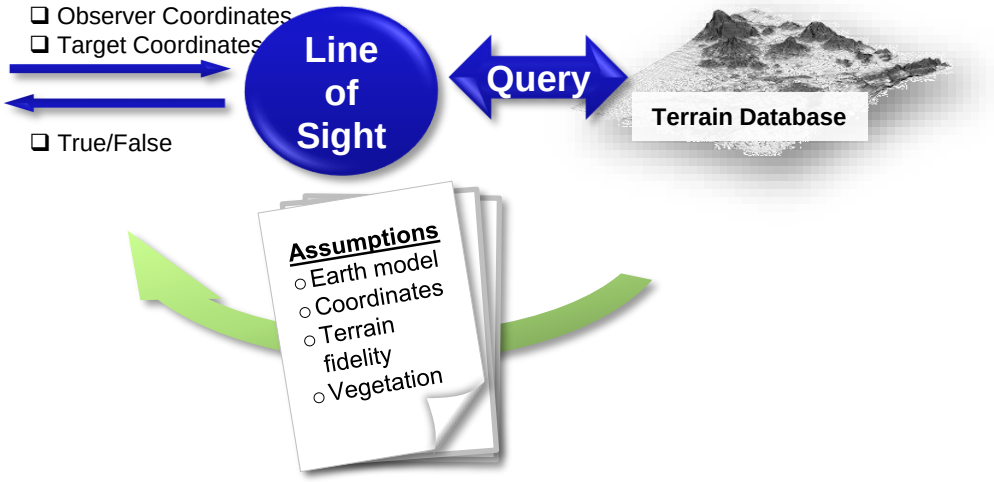
Architectural and Engineering Challenges

- **Managing a hybrid architecture that maintains interoperability with legacy systems**
- **Decomposition of legacy systems into reusable components**
- **Development of standards to facilitate composability of models**
  - Common conceptual model/framework for assembling components
  - Verification and Validation of composed simulations

Unique M&S Challenges to Modular, Open System Approach

The bank keeps the definitive record of the amount of money in an account



The terrain database is a representation of the terrain based on a set of simplifying assumptions; those assumptions affect the suitability and accuracy of the data

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Enterprise-wide Interoperability and Reuse Challenges

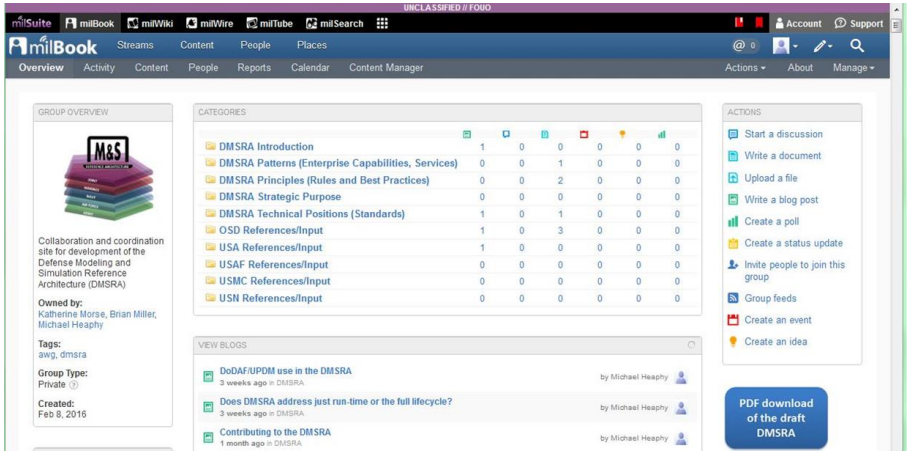
- **Implementing governance structures that enable and encourage modular, open-systems approaches**
- **Facilitating trust between simulation developers, dependent upon other model and simulation developers who may not be in their program chain.**
  - This will require simulation program managers to accept some risk
  - It will also require adoption of common conceptual model (s) or frameworks

How the DMSRA is Addressing the Challenges

- **Collaborative approach**
- **Leverage existing investments**
- **Develop patterns that capture best practices, and gaps in standards, technology and practice**

Collaborative Approach

- **M&S COI Architecture Working Group (AWG)**
  - 36 briefings on architecture / framework initiatives
  - Includes briefings from all 4 Services, MDA, Joint Staff, and NATO
  - Domains
    - Training
    - T&E
    - Acquisition
    - Experimentation
    - Analysis



- **Online collaboration**
  - Emphasizes the dynamic and collaborative nature of the DMSRA
  - Makes the revision process more transparent
  - Makes it easier to contribute to the DMSRA
  - Makes contributions immediately available and easier to find
  - https://www.milsuite.mil/book/groups/dmsra (DoD CAC only)

Leveraging Existing Investments

- **The DMSRA effort builds on the Live, Virtual, Constructive Architecture Roadmap (LVCAR) principles:**
  - Do no harm
  - Interoperability is not free
  - Start with small steps
  - Provide central management
- **Other investments and resources leveraged:**
  - Defense M&S Glossary
  - Verification, Validation, and Accreditation (VV&A) Recommended Practices Guide
  - DoD and NATO standards references and tools
  - Services' architecture(s) artifacts and practices

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Patterns: Best Practices and Gaps

- **Extensibility via Patterns**
  - The base document and initial patterns were not sufficiently comprehensive to meet the DMSRA vision
  - Led to the use of modular patterns to extend and evolve the DMSRA with new technologies and associated best practices.
- **DMSRA Pattern Outline:**
  - **Pattern overview:** Frames topic with definitions, technology description, and relevance to the DMSRA
  - **Mapping from Capabilities, and Principles and Rules:** aligns capability with DMSRA principles
  - **Pattern:** Provides a series of questions the user should ask in the process of deciding whether to apply the technology/capability. Documents guidance and best practices for answering the questions in context based on inputs from the AWG.
  - **Technical Positions:** Identifies applicable standards, including DoD adoption status; and standardization gaps
  - **References**

Current Patterns Findings (1 of 2)

- **Cloud migration**
  - Lower overall costs to the consumer, because of efficiencies obtained by pooling much of the computing hardware and software;
  - IT functions and increased flexibility because there is no upfront investment in infrastructure required by the end user
- **Service-oriented architecture**
  - The Department of Defense (DoD) Chief Information Officer (CIO) has directed the DoD to leverage commercial SOA technologies to reduce costs and increase flexibility.
  - This pattern aids the user to determine the suitability of an organizational capability for migration to a SOA from technical, programmatic, and domain perspectives.

Current Patterns Findings (2 of 2)

- **Decomposition of simulations into modular components**
  - Although much has been written about modular simulation, there is a gap for M&S-specific standard practices for decomposition.
- **Verification and validation of modular components**
  - Cloud computing considerations: The hardware and operating system the simulation is hosted on are out of the control of the user and may be altered from the configuration used during validation without the user's knowledge.
  - V&V of composed simulations: composition of validated component models does not ensure a valid composed simulation. This is a known gap in standards and practice.

Way Ahead

Continue collaborative approach to capturing best practices in patterns, including the following topics:

- **Accommodating occasional / sporadic connectivity**
- **Cross domain solutions**
- **Distributed simulation and federation engineering**
- **Data**
- **Assessing the feasibility of remote execution**
- **Gaming architectures**

Continue to leverage DoD enterprise architecture and IT capabilities and practices:

- **Cloud computing**
- **MOSA and SOA practices and standards**

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QUESTIONS?

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