

The Intellectual Property (IP) Thread in Digital Engineering and Acquisition Implementation in the Department of Defense (DoD)

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Abstract

As Digital Engineering (DE) matures in DoD Acquisition and becomes more widespread, workstreams (“threads”) in acquisition systems engineering and acquisition process that support the lifecycle, are critical to be included in the digital acquisition system model. This presentation will discuss the synergy and dependency between systems engineering and acquisition, and how IP considerations early in an acquisition have large effects in any outcome – as well as being a controlling factor in optimizing the systems engineering design and overall acquisition.

Agenda

- What is Digital Engineering and Model-Based Systems Engineering?
- What is the Digital Thread?
- What is a Reference Architecture?
- What is Intellectual Property in the DoD?
- Model-Based Digital Acquisition
- How do we protect and use IP in a DE environment ?
- Some Key IP Thread Considerations in Model-Based Acquisition
- Recommendations for NDIA SE Division

What is Digital Engineering?

“An integrated digital approach that uses authoritative sources of systems’ data and models as a continuum across disciplines to support life cycle activities from concept through disposal “ (DoD Definition)



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What is Model-Based Systems Engineering?

“Model-based systems engineering (MBSE) is the formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases”¹.

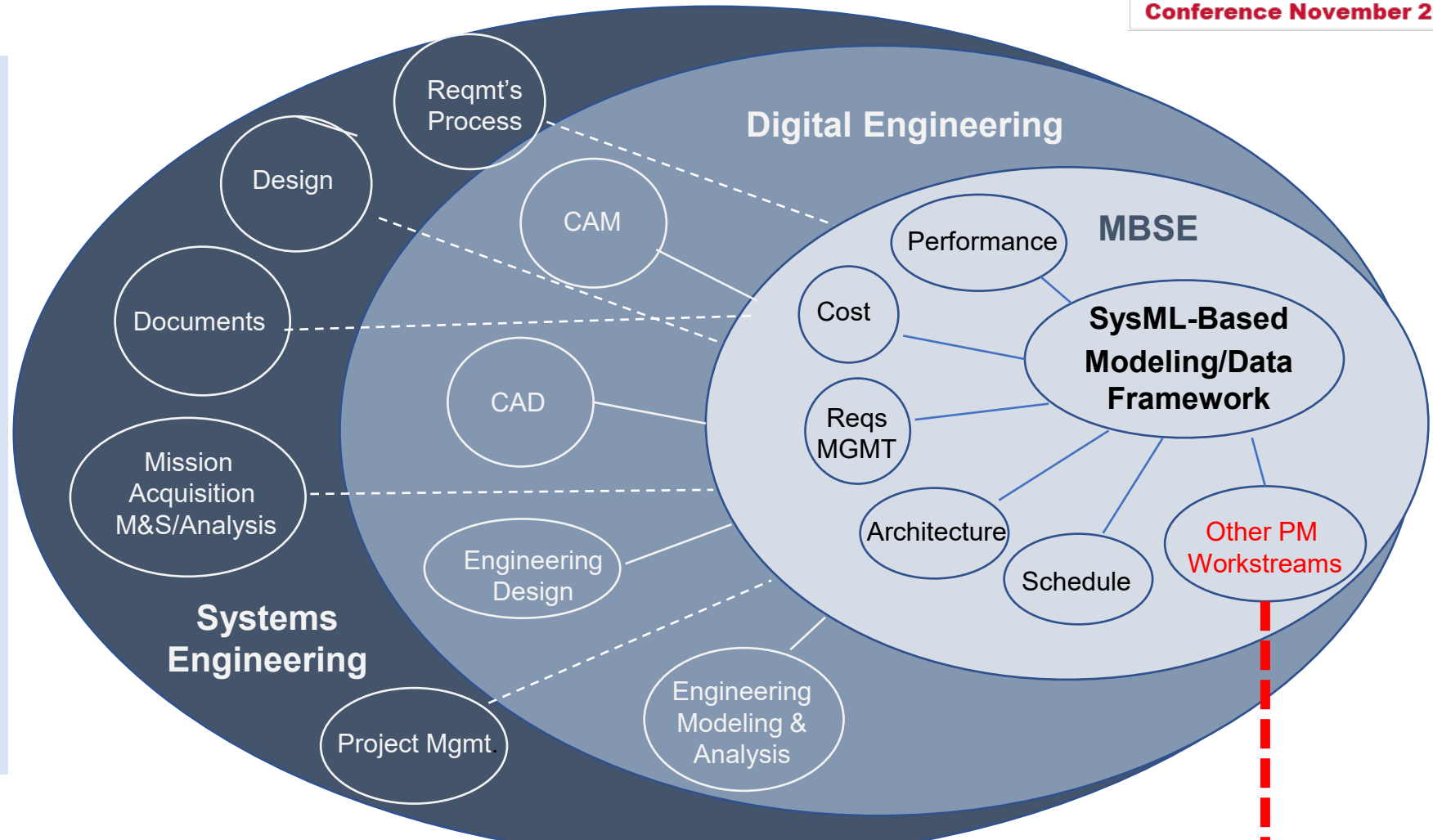
“Model-Based Systems Engineering (MBSE), a.k.a. Model-Based Systems Development (MBSD), is a Systems Engineering process paradigm that emphasizes the application of rigorous architecture modeling principles and best practices to Systems Engineering activities throughout the System Development Life Cycle (SDLC).”²

MBSE is structured, architecture-based modeling used to represent all Systems Engineering processes in a system (Cost, Schedule, Performance, Engineering Design etc.) as models. This is a “process of processes” modeling of many SE processes simultaneously – yielding the insights in their interactions and simultaneous execution in a system.

This can enable complex process modeling to include System of Systems and Acquisition!

The Digital Engineering/ MBSE Puzzle

- Digital Engineering and MBSE support the systems engineering process of developing a capability. **Digital Engineering includes much more than MBSE** – all engineering digital processes and analysis
- **MBSE is a process tool** that instantiates systems engineering and its processes in a digital construct
- **MBSE is the “glue”** that integrates all these activities **digitally**, “stores” the digital data associated with these processes, and contains the system architecture and all its attributes

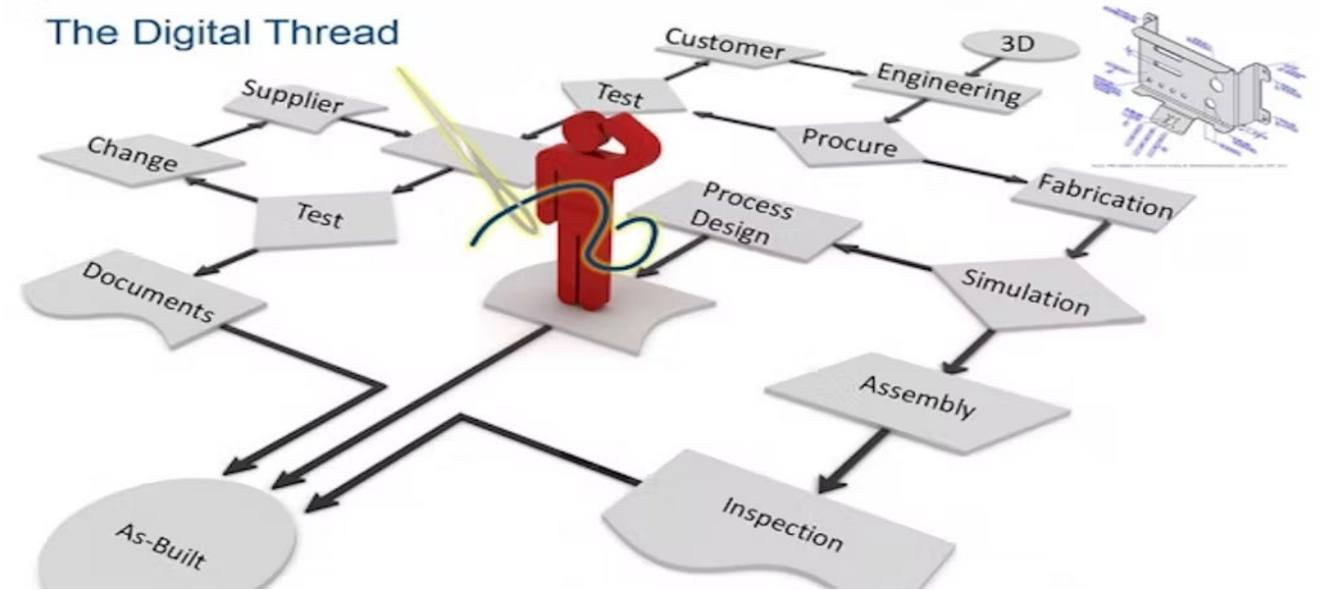


“Other PM workstreams” can include other business/DoD processes (e.g IP, Contracting, Intel, Cyber etc...) or even other acquisition processes!

What is the Digital Thread?

Digital Thread is "a data-driven architecture that links together information generated from across the product lifecycle and is envisioned to be the primary or authoritative data and communication platform for a company's products at any instance of time."¹

Digital Thread refers to the communication framework that allows a connected data flow and integrated view of the asset's data throughout its lifecycle across traditionally siloed functional perspectives."²



Digital Threads seek to create simple universal access to functionally arranged data and models. This can be an MBSE or other process modeling environment thread

- They follow a set of functionally relevant processes and related data as they weave in and out of SE and acquisition business processes to enable continuity, accessibility, and traceability (pedigree)
- They are process models with their base data and form an available “authoritative source of truth”

Digital Thread: An Expanded View

*The SERC is supporting Digital Engineering (DE) efforts through research tasks such as Transforming Systems Engineering through Model Based Systems Engineering and the Engineered Resilient Systems program. These efforts are focused on assessment and development of collaborative digital engineering environments as an evolution in processes, methods, and tools. However, additional research is needed to characterize the related path for the DoD acquisition enterprises: **Digital Thread Enabled Acquisition**¹*



Clearly, there is more than one Digital Thread!

- Digital Threads can follow multiple functional process flows across SE and acquisition process in a “Process of Processes” manner
- The number is infinite, depends on how many levels of detail are required to describe the acquisition for whatever purpose
- When modeled simultaneously, these Digital Threads interact and more completely describe the system/acquisition

The world is not linear! You can't model one strand at a time!

What is a Reference Architecture?

*A **Reference Architecture** or model provides a common vocabulary, reusable designs, and industry best practices that are used as a constraint for more concrete architectures. Typically, reference architecture includes common architecture principles, patterns, building blocks, and standards. They are not solution architectures (i.e., they are not implemented directly)¹.*

In an implementation we should:

- Apply Across the Complete System Lifecycle
- Include a digital framework of SE processes
- Use a federated modeling environment with data & model integration and traceability (MBSE?)
- Use a Digital Thread for the “Technical Baseline” and “Authoritative Source of Truth”
- Include integrated acquisition (business) process in the baseline (IP?)

What is Intellectual Property¹ in the DoD?

- **Intellectual Property (IP):** Information, products, or services that are protected by law as intangible property, including data (e.g., technical data and computer software), technical know-how, inventions, creative works of expression, trade names.
- **IP deliverables:** Products or services (including information products and services) that are required to be delivered or provided to the U.S. Government by contract or other legal instrument and that include or embody IP (e.g., technical data and computer software).
- **IP rights:** The legal rights governing IP, including ownership as well as license or other authorization to engage in activities with IP (e.g., make, use, sell, import, reproduce, distribute, modify, prepare derivative works, release, disclose, perform, or display IP).

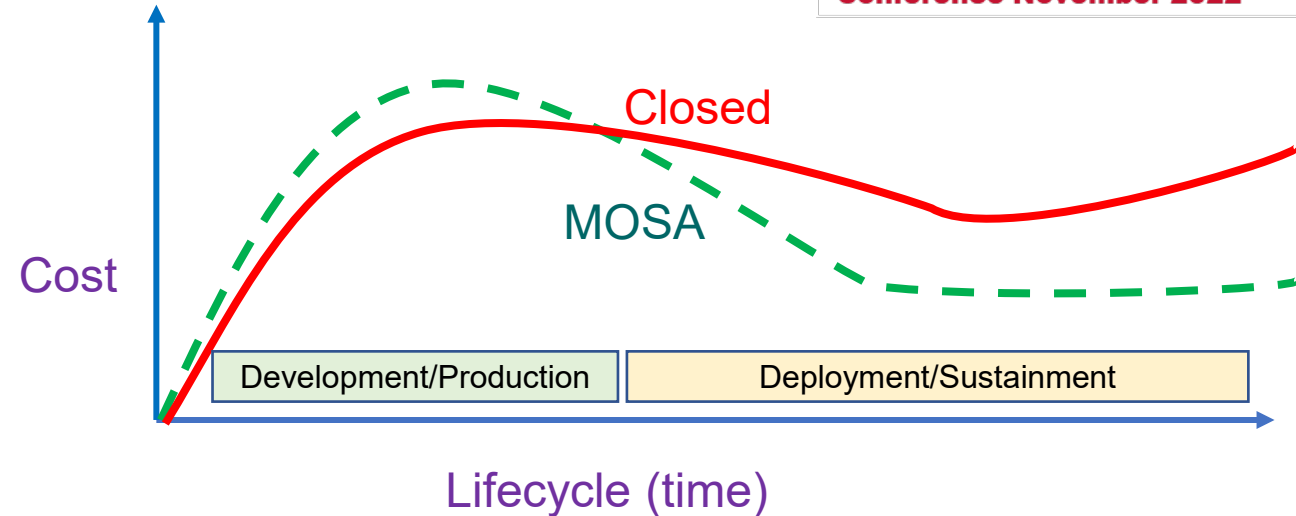
Some Key IP considerations from DODI 5010.44:

- **Integrate IP planning** fully into acquisition strategies and product support strategies
- **Seek to acquire only those IP deliverables and license rights necessary** to accomplish these strategies
- **Negotiate specialized provisions for IP deliverables and associated license rights** whenever doing so will more effectively balance DoD and industry interests than the standard or customary license rights.
- **Respect and protect IP** resulting from technology development by both the private sector and the U.S.G..
- **Clearly identify and match data deliverables with the license rights in those deliverables.** Data or software deliverables are of no value unless and until the license rights to use it are attached

How does IP effect SE in an Acquisition?

Modular Open Systems Approach example:

- **Program A** is closed, low modularity, with unpublished/unavailable interfaces
- **Program B** is MOSA, published interfaces:
 - Modularity and the IP required purchased initially lead to MOSA initial cost increase
 - MOSA system yields cost savings and other benefits later in lifecycle
- The optimal approach is **Program A** for initial program cost optimization, **Program B** for Lifecycle cost optimum



Some Observations:

- The optimal technical/SE solution alone may not yield the best long term technical capability that MOSA enables (*Rapidly deploy new technology, Opportunities for technical upgrades and refresh, Interoperability, including new/unintended mission use*)
- The lowest initial cost solution may be more expensive over the lifecycle
- It may cost more initially to purchase the IP rights and data to implement MOSA but gain flexibility and cost savings later- and other benefits of MOSA

- To implement MOSA you have to buy the IP up front – the effects of that are in the future!
- To make these trade-offs up front, it requires a digital model of both systems to optimize!

Digital Acquisition Concept

NDIA/DAU/USD(R&E)/etc

NDIA

Systems and Mission Engineering
Conference November 2022

- NDIA Working Group

- Conceptual framework and Reference Architecture For a Digital Acquisition Thread

- This concept can bring the business process of acquisition into the MBSE environment as additional processes to the mix!

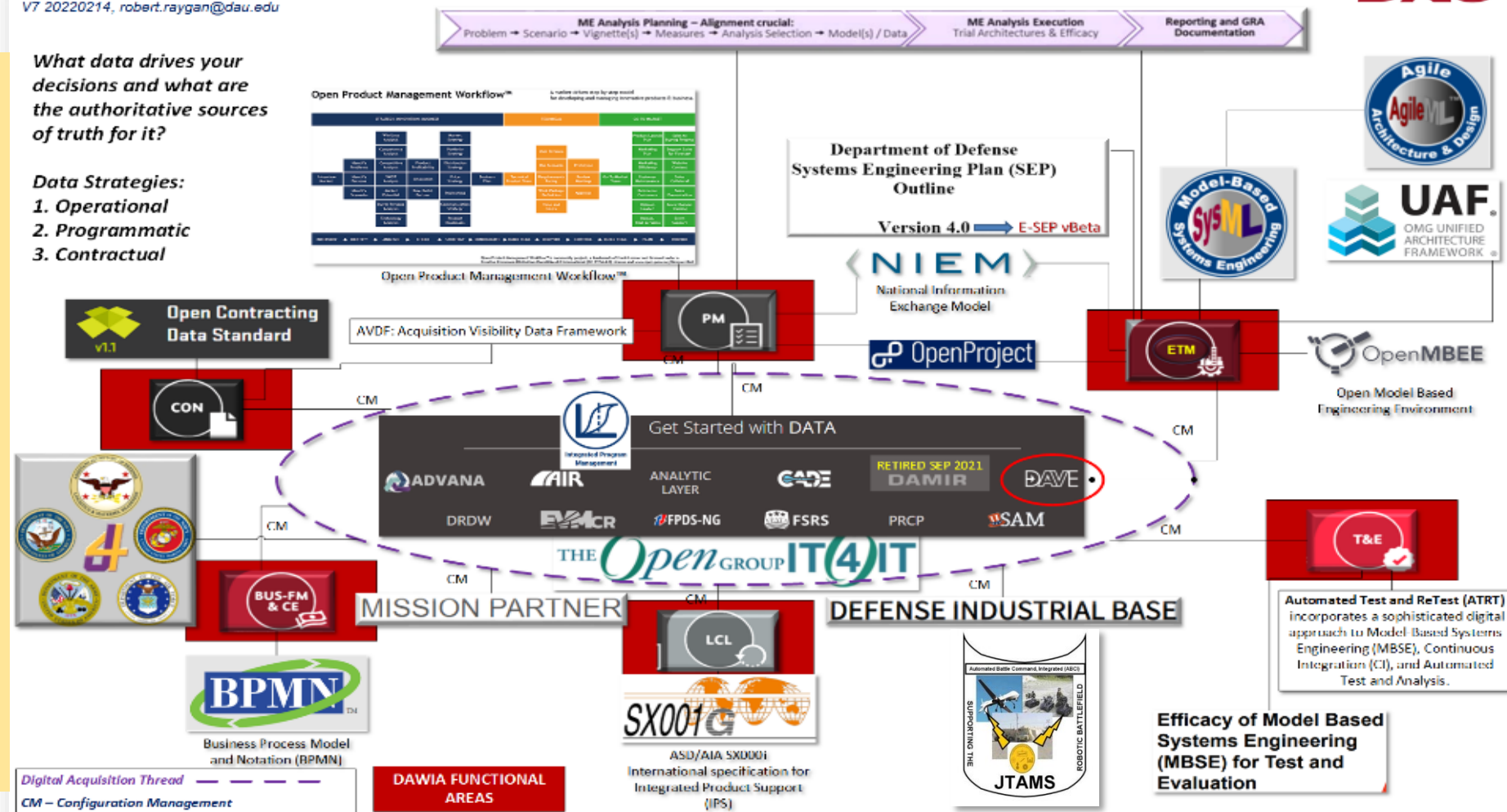
DoD Digital Acquisition Thread Reference Architecture Concept

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What data drives your decisions and what are the authoritative sources of truth for it?

Data Strategies:

1. Operational
2. Programmatic
3. Contractual



Model-Based Digital Acquisition (MBDA)

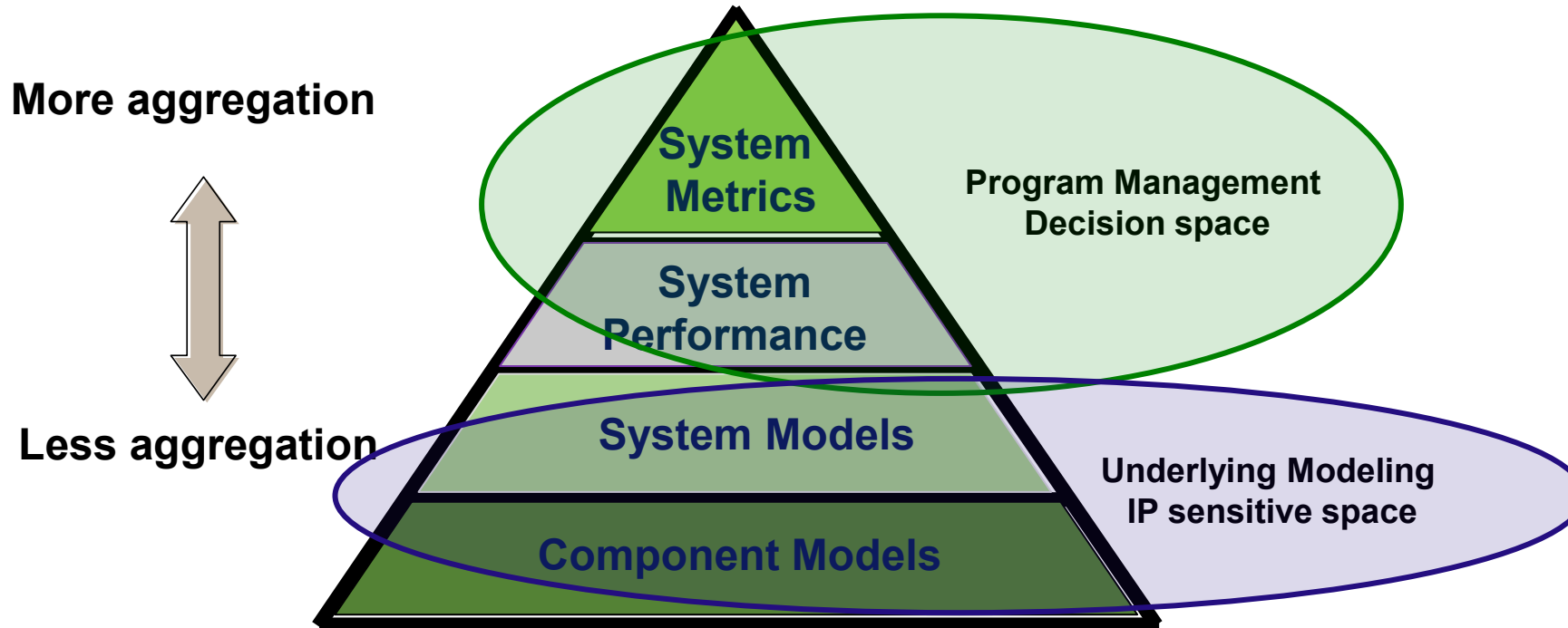
- Combine the Digital Acquisition Thread with the modeling environment of MBSE- in use in DoD programs today – moving beyond systems engineering to all of Acquisition
- Organize data to function/purpose over a program's acquisition lifecycle using MBSE modeling tools and the Reference Architecture:
 - ***A Model-based approach:***
 - Requires an organized entity structure for models and data along a functional process (“Threads”) – such as the Intellectual Property acquisition business process
 - Needs the prerequisite digital structure to **support modeling any SE/acquisition process**
 - **Provides the required digital modeling environment for optimization of any kind** (e.g “trade space”, “lowest cost”, “most effective”, “sustainability”, “lethality”, “interoperability” etc..)
 - ***Why not use MBSE tools/approaches as currently used for Systems Engineering?***
 - MBSE can be used to model acquisition business process as well as SE processes, adding more complex “Threads” into the overall model of the system, and its acquisition

If we view the acquisition lifecycle as an overall process, then we can use MBSE to model this “process of processes” where the **Intellectual Property Strategy and business process** is part of our overall mix of SE/acquisition processes and included in all our “trade-space” and optimization analysis

Sensitive IP Information:

Aggregation/Abstraction a modeling solution?

Aggregation. The process of grouping entities while preserving the salient effects of entity behavior and interaction while grouped¹:



- As we move **up the pyramid** the information is **broader and more important** to the PM/Decision-maker
- As we go **down** it is more **granular and focused**; becomes very descriptive of the system and components
- **PM's and Decision-makers need the outputs from modeling at the upper levels, details below are not as important**

If we want to “mirror” a manufacturer proprietary model for digital acquisition purposes.. Why not draw the “thread” to surrogate (Black Box) the sensitive models in the lower end of the pyramid?

Some Key IP Thread Considerations in Model-Based Digital Acquisition (MBDA)

(1) IP Deliverables:

- How do we provide “access and use” of that data/information in an MBDA environment (“rental”)?
- What constitutes “delivery”? Negotiated access and for how long?

Explore negotiated access to an MBDA environment at some agreed upon level of detail with a producer and/or a “mirror” environment . Look towards ‘use” more than “ownership” in IP, just as we do routinely in software

(2) IP Rights:

- How do we build an “IP Strategy” workstream in an MBDA environment?

Link IP Rights to elements in an MBDA representation of the entire acquisition and script the IP Strategy as a process into the digital thread for IP in MBDA

(3) **IP (Trade Secrets etc..) are handled traditionally similarly to data- we just don’t include in a document what we don’t want to. In an MBDA environment we need that information or a surrogate to create the model in the first place:**

- How do we model and entity/process completely without including IP sensitive data and representations?

Use Abstraction/Aggregation techniques to “Black Box” the detailed Trade Secrets out of the delivered model

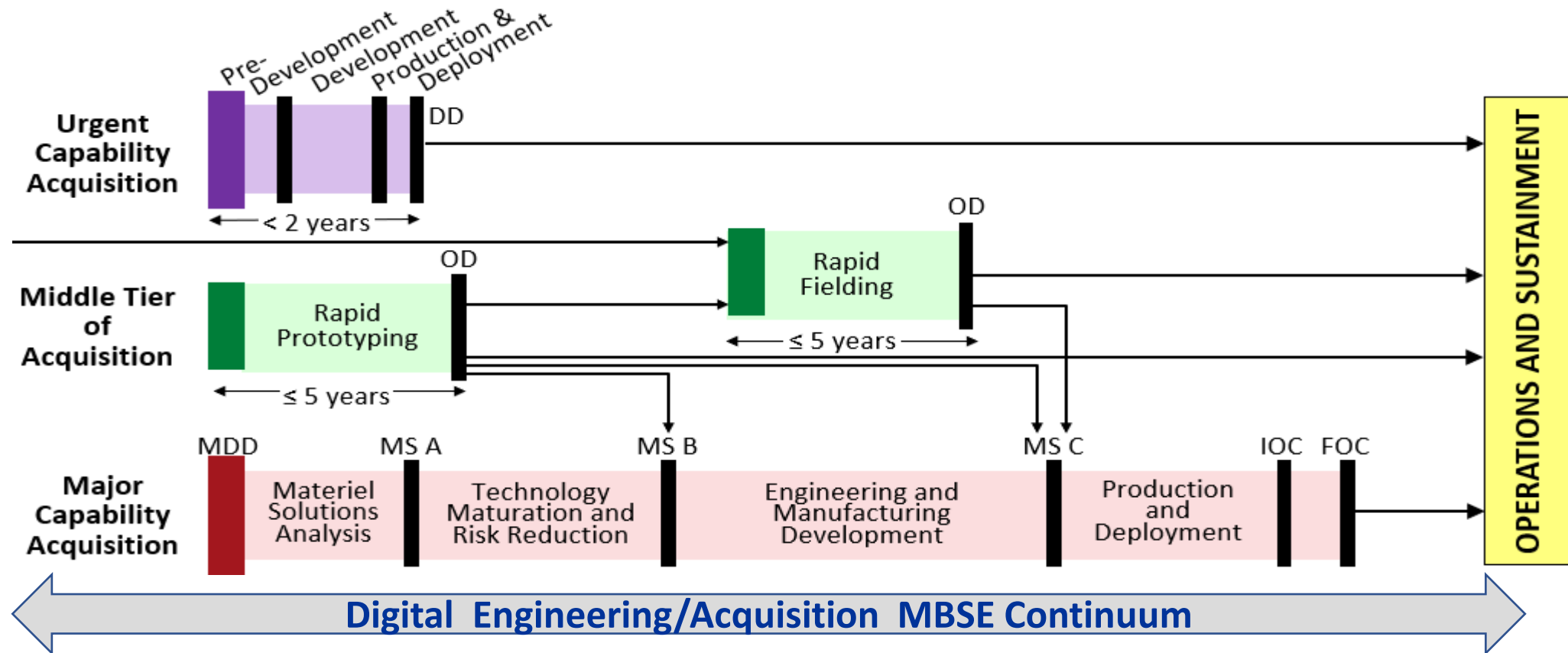
Recommendations for NDIA SE Division

- (1) Support the ongoing Digital Acquisition Concept and reference Architecture activity leveraging MBSE adoption for Systems Engineering*
- (2) Engage with the DoD/Services IP Cadre on the implementation of a Digital Acquisition Concept and in defining the IP Digital Thread*
- (3) Develop technical approaches to implementing IP workstreams into MBSE and system engineering baselines*
- (4) Leverage the interest in “Digital Threads” to define how we can integrate Systems Engineering, Product support, manufacturing, and acquisition business processes in a model-based lifecycle continuum – MBDA?*

Questions?

Backup

Using MBSE Across Acquisition



Use of MBSE can put SE and Acquisition processes in a digital construct, modeling the process of processes , archiving their digital data, and making data and models accessible and consumable from stage to stage

What is IP Policy in DoD Acquisition?

It is DoD policy (DODI 5010.44) to acquire, license, and manage IP to¹:

- (1) Enable coordination and consistency across DoD Components in developing and implementing strategies for acquiring and licensing IP and communicating with industry.**
- (2) Ensure that program managers are aware of the rights and obligations of the Federal Government and contractors in IP, and that program managers fully consider and use all available techniques and best practices for acquiring and licensing IP early in the acquisition process.**
- (3) Encourage customized IP strategies for each system based on, at a minimum, the unique characteristics of the system and its components, the product support strategy for the system, the organic industrial base strategy of the military department concerned, and the commercial market.**

Clearly, this puts the IP business process as a key responsibility of PM's and that an acquisition needs to have an IP strategy... BUT this is a systems engineering responsibility as all systems engineering activities have an IP attribute/dependency - overt or implied

1. Ref: DOD INSTRUCTION 5010.44 INTELLECTUAL PROPERTY (IP) ACQUISITION AND LICENSING; <https://www.esd.whs.mil/dd/dod-issuances/>

What is the IP SE/Business Process?

Need look no further than DODI 5010.44 “*additional core DoD IP Principles*”¹:

- **Integrate IP planning** fully into Acquisition strategies and product support strategies to protect core DoD interests
- **Seek to acquire only those IP deliverables and license rights necessary** to accomplish these strategies, bearing in mind the long-term effect on cost, competition, and affordability.
- **Negotiate specialized provisions for IP deliverables and associated license rights** whenever doing so will more effectively balance DoD and industry interests than the standard or customary license rights.
- **Respect and protect IP** resulting from technology development investments by **both the private sector and the U.S. Government.**
- **Clearly identify and match data deliverables with the license rights** in those deliverables. **Data or software deliverables are of no value unless and until the license rights to use it are attached, and the U.S. Government actually obtains and accepts those deliverables**

**OK.. A lot of IP processes... needs implementation materials, training and management to implement...
but what if this is an included workstream in an MBSE Digital engineering environment??**

1. Ref: DOD INSTRUCTION 5010.44 INTELLECTUAL PROPERTY (IP) ACQUISITION AND LICENSING; <https://www.esd.whs.mil/dd/dod-issuances/>