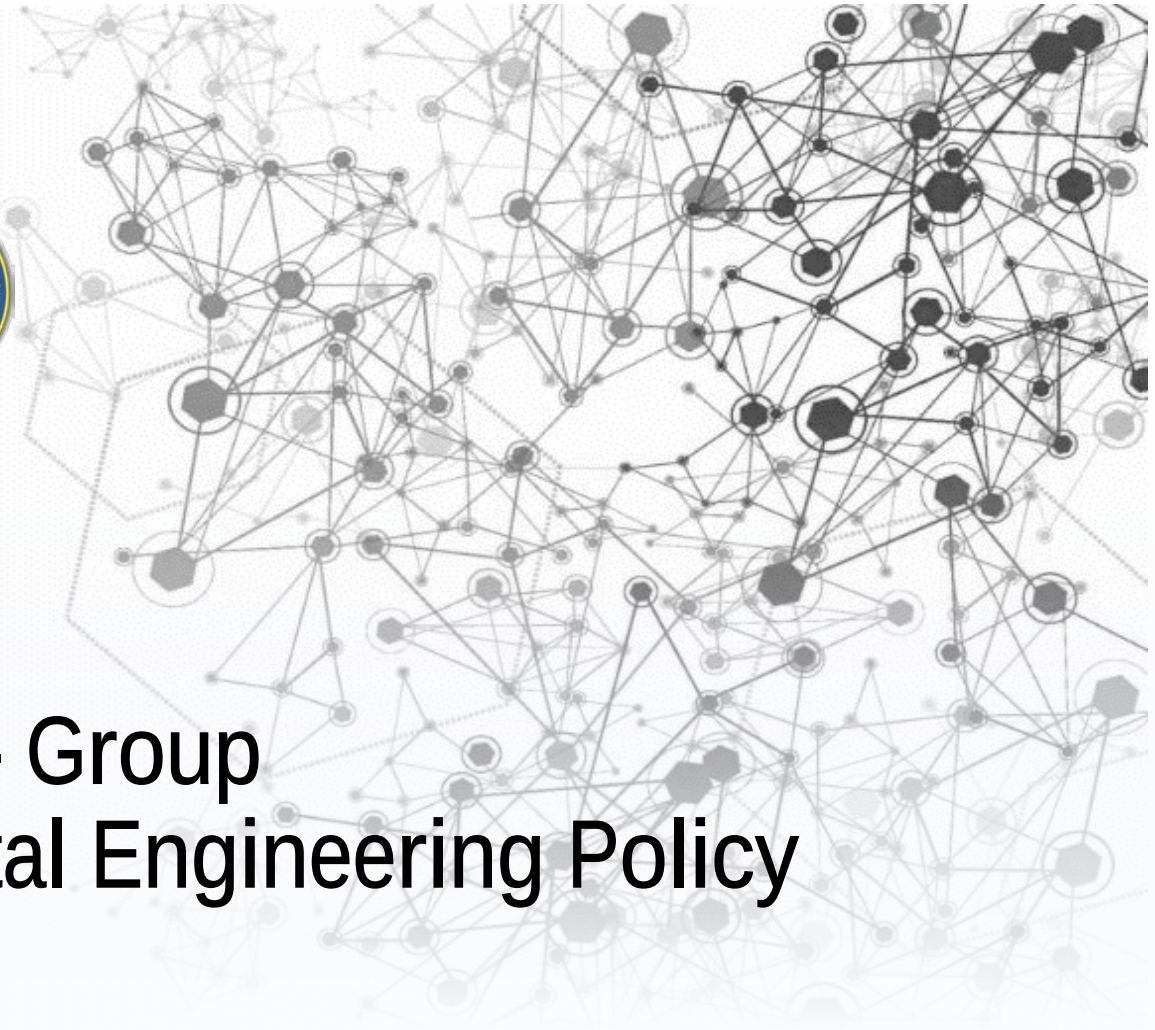


Digital Engineering Information Exchange Working Group (DEIXWG):
Standards Framework (SF) Sub- Group
Standards supporting DoD Digital Engineering Policy

Celia Tseng

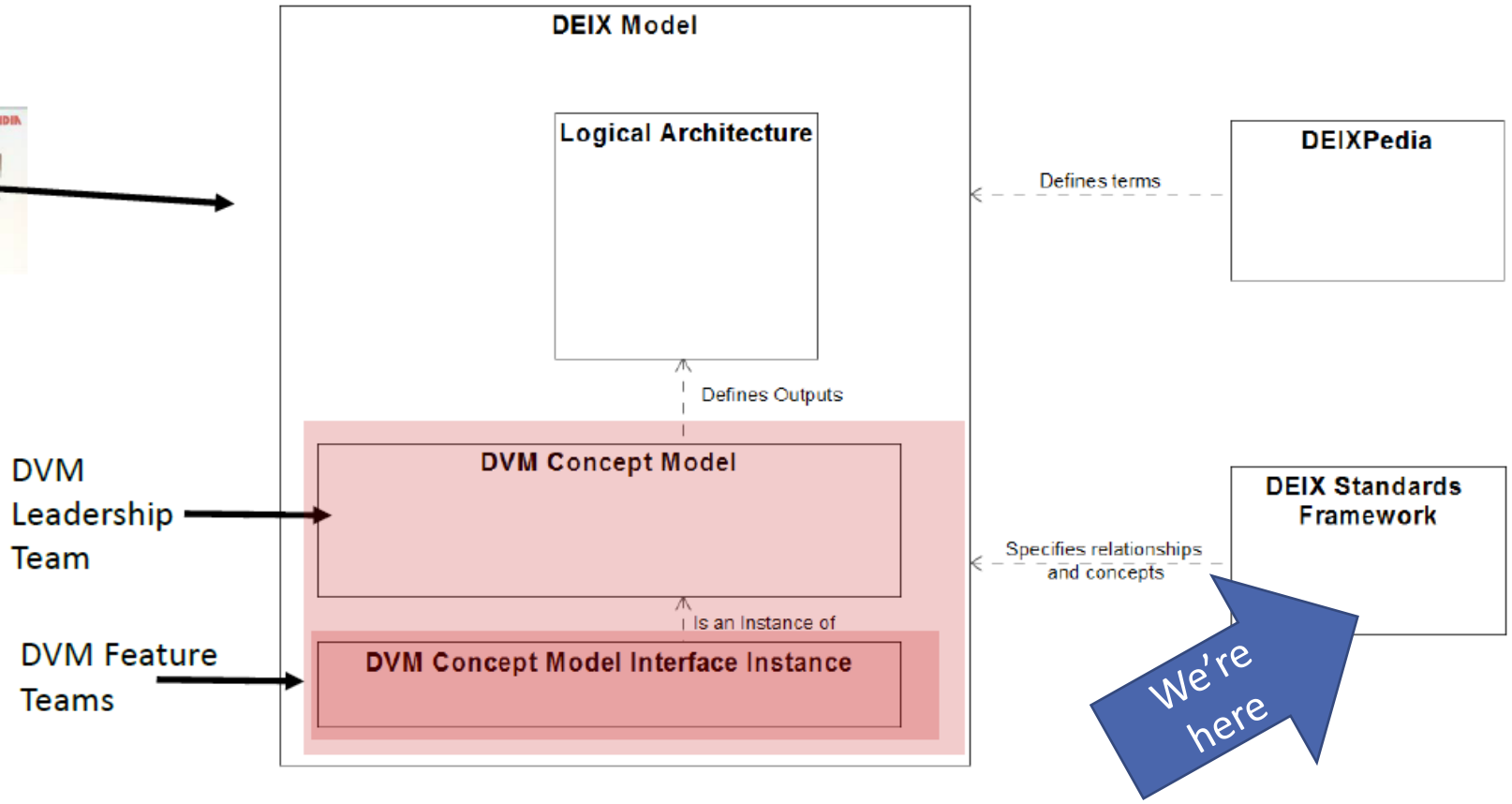
DEIX-SF Lead

Celia.s.Tseng@Raytheon.com

Raytheon

Inter-relationship between DEIX WG Product teams

(much appreciation to Chris Schreiber)



The Need for DEIX-SF

- No industry-wide agreement on standards or conventions to enable a universal exchange of digital artifacts between buyers and suppliers in a global supply chain
- Challenges:
  - ***NO STANDARDS***: No agreed conventions for entities that want to participate in a digital engineering ecosystem to share or exchange their engineering information
  - ***COMPETING STANDARDS***: Many related industries, professional disciplines, and open communities have competing, duplicative, or inconsistent standards for information exchange
  - ***COMPLEXITY***: Difficulty in achieving dominant standards naturally with the degree of diversity among model information, stakeholders, and interrelationships

Why do we need standards

- Standards promote safety, quality, and consistency in the products and processes
- Standards provide the bases for buyer-seller transactions
- Benefits:
  - Reduced Cycle Time
  - Repeatable processes
  - Increased Quality
  - Increased Commonality
  - Leverage best practices

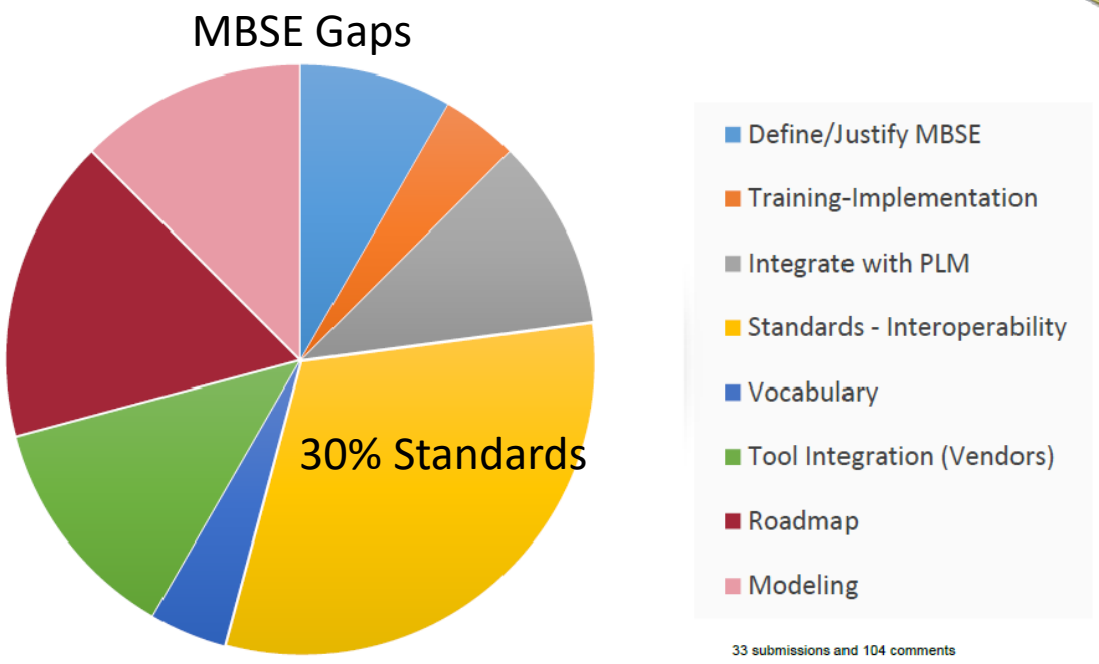


Image taken from 2017 GPDIS presentation by Mark Williams and Greg Pollari

98 participants, 12 teams, 33 written submissions and 104 comments

National Defense Industrial Association

The Product Development Project:
Develop Digital Engineering Information Exchange Standards Framework (DEIX-SF)
Project Lead: Celia Tseng

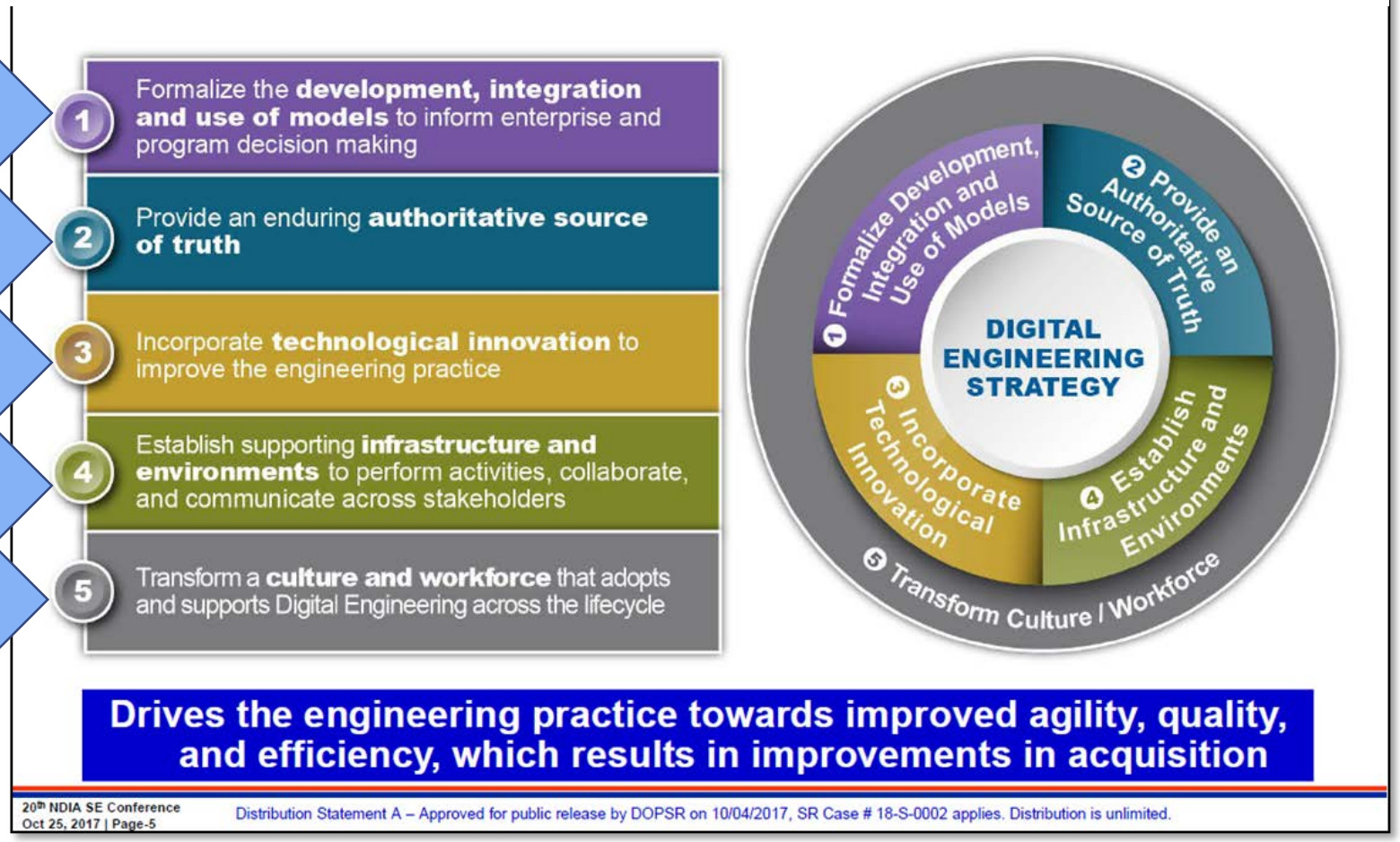
- **The Effort**: Create a framework for official standards related to Model-Centric Information Exchanges

  - ***IDENTIFY needs for standards*** to facilitate seamless exchanges of model-centric digital artifacts
  - ***REVIEW existing standards*** for content for relevance to needs for standards.
  - ***ANALYZE relevant standards*** to determine acceptability, overlaps, and gaps
  - ***CREATE*** a ***standards hierarchical framework*** and references to acceptable standards
  - ***RECOMMEND to INCOSE Standards Committee*** modifications or new standards to fill gaps or meet needs

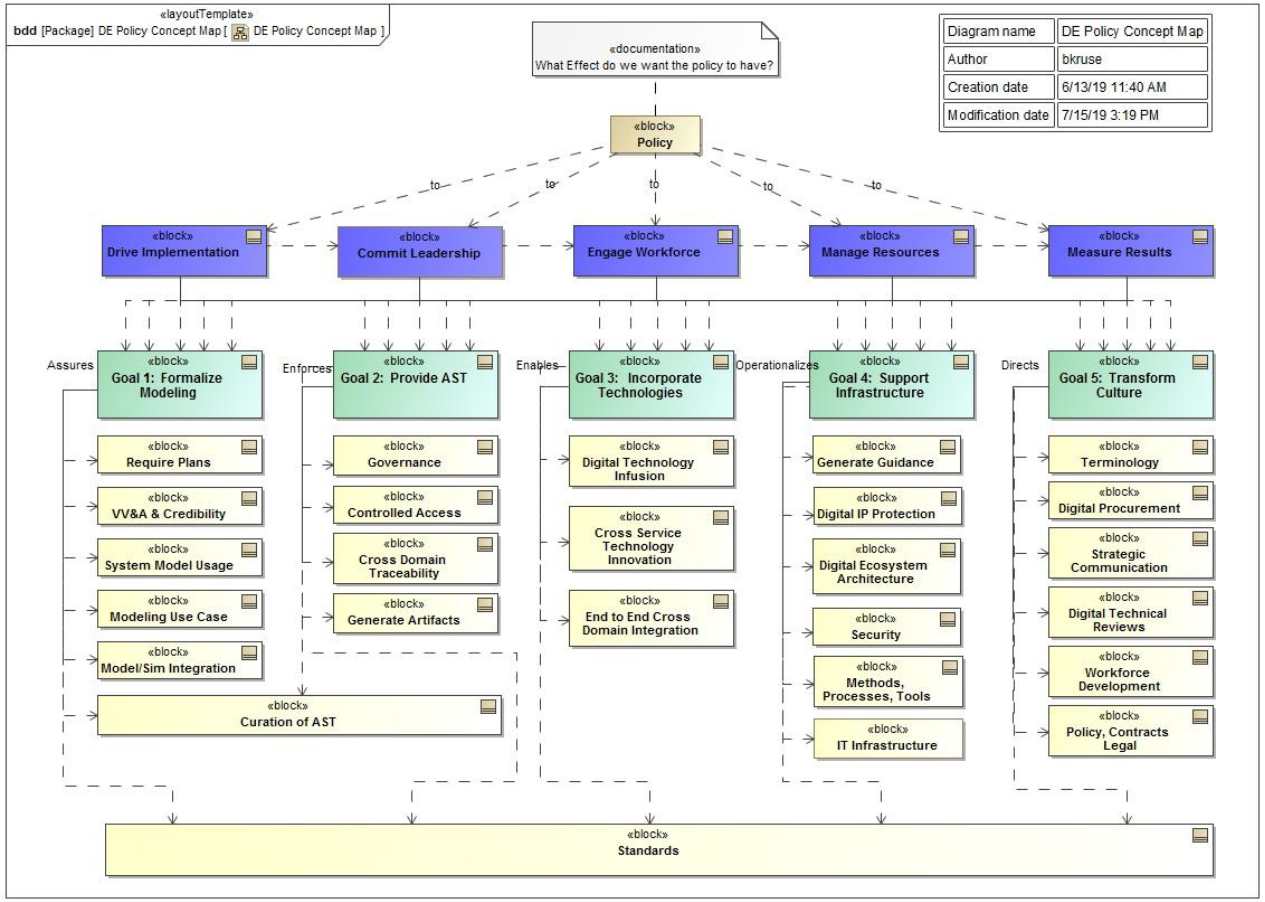
For More Information Go To OMG MBSE Wiki:
http://www.omgwiki.org/mbse/doku.php

Q: What standards will help facilitate DoD DE Strategy?

- Formalize Modeling
- Provide AST
- Incorporate Technologies
- Support Infrastructure
- Transform Culture



Let's survey the landscape in Standards Development applicable to the DE Initial Concept Map

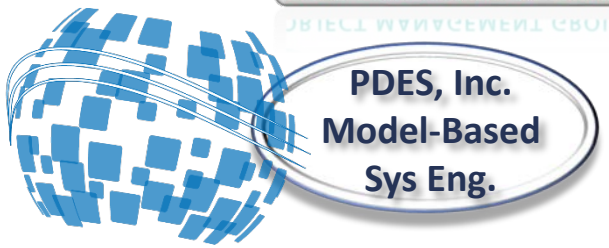


From DoD Digital Engineering Policy, Philomena Zimmerman, INCOSE IS 2019
Distribution Statement A: Approved for public release. Distribution is unlimited. DOPSR case # 19-S-1918.

MBSE Standard Enablers

A&D PLM Action Group

Standardization Days



INCOSE – PDES MoU

SmartSE

MBSE for PDES

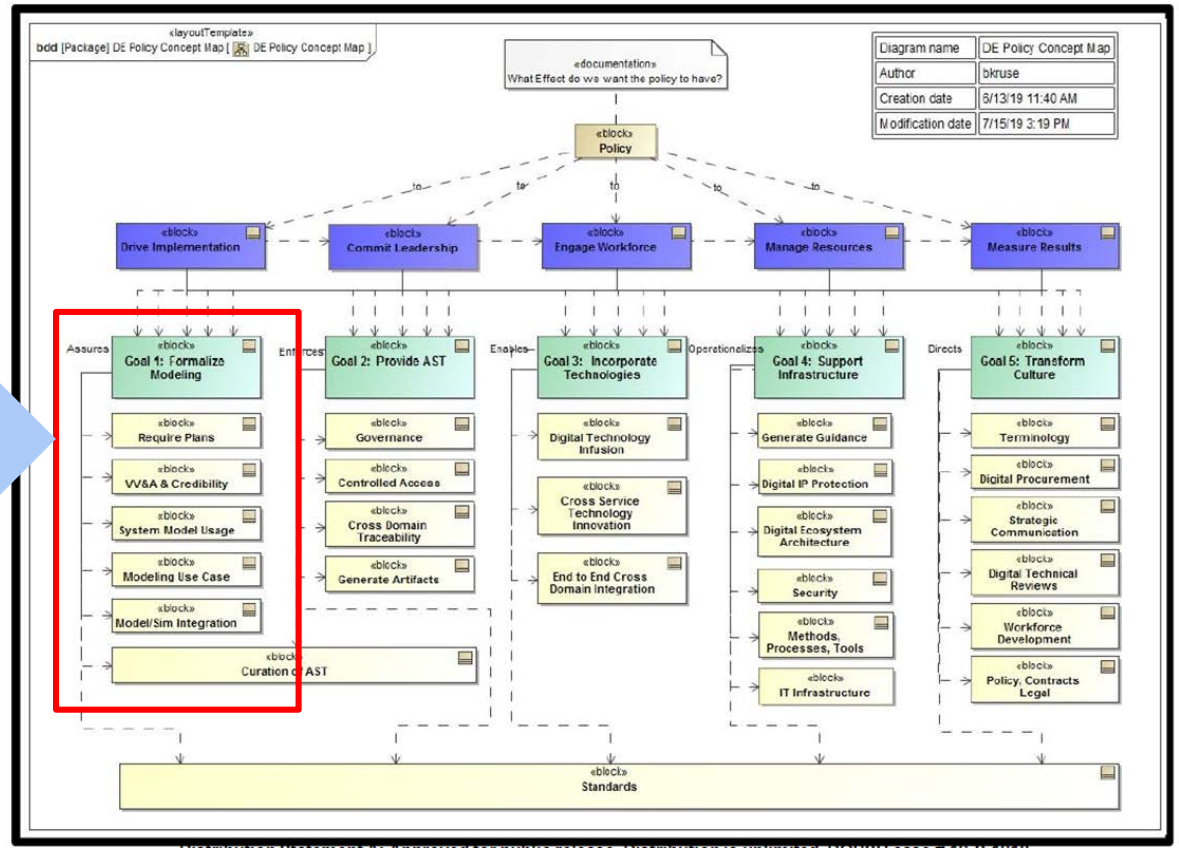
INCOSE TIMLM

and DEIX WGs

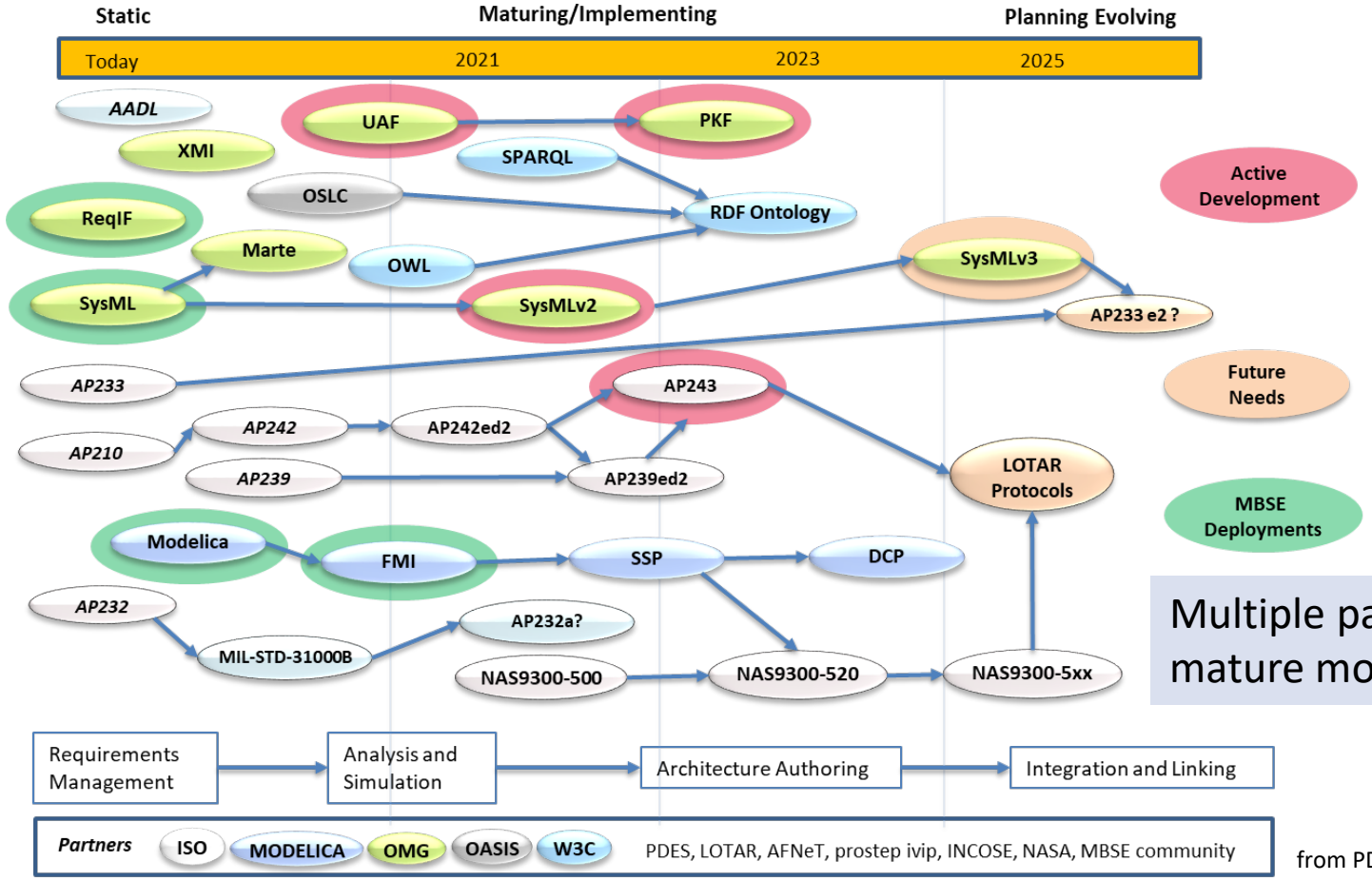
LOTAR for MBSE

Formalize Modeling

- Require Plans
- VV&A
- System Model Usage
- Modeling Use Case
- Model/Sim Integration
- Curation of AST



MBSE Data Standards Roadmap

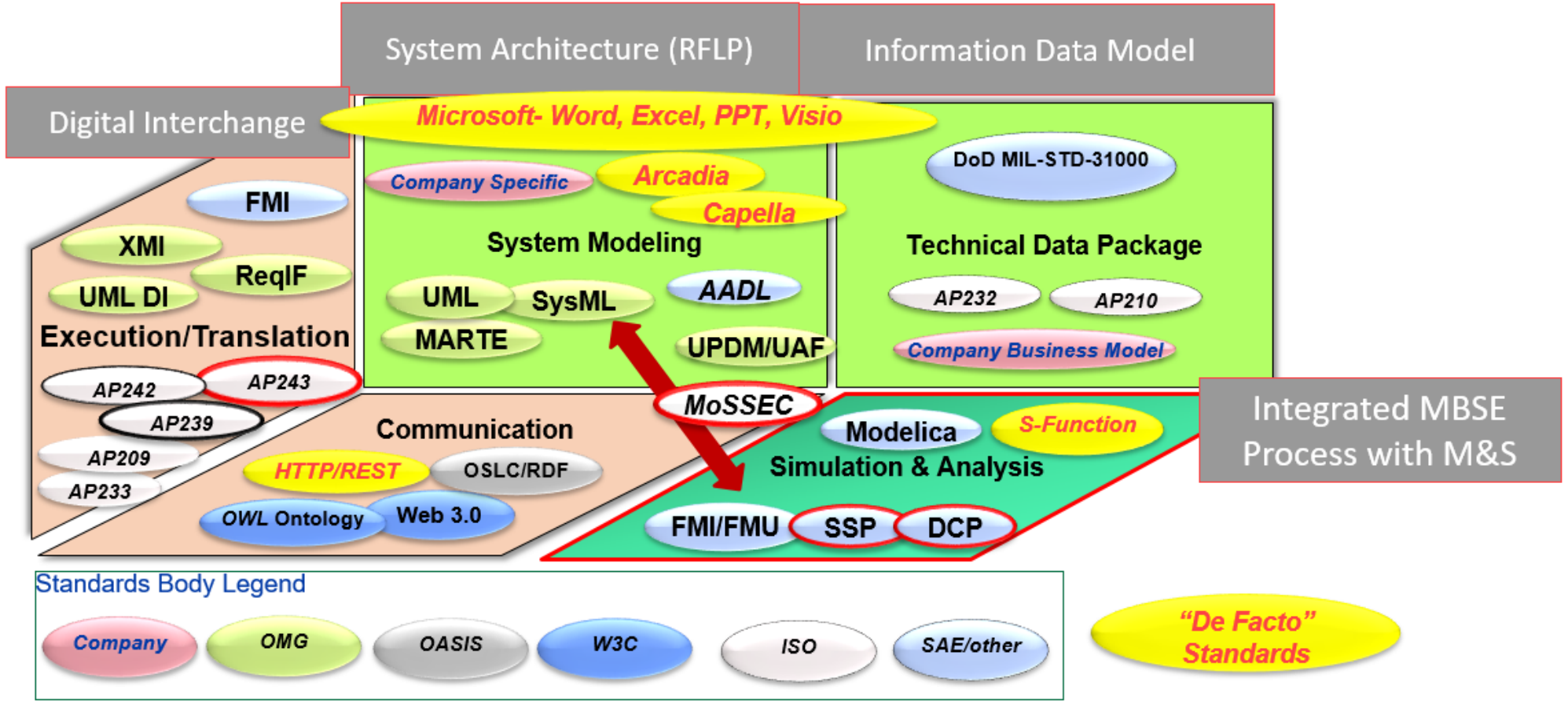


Multiple partners are working to mature modeling standards

from PDES-LOTAR MBSE Conference, May 8th, 2019. Revised July 8th, 2019

Reference ASD Radar Chart for detailed descriptions

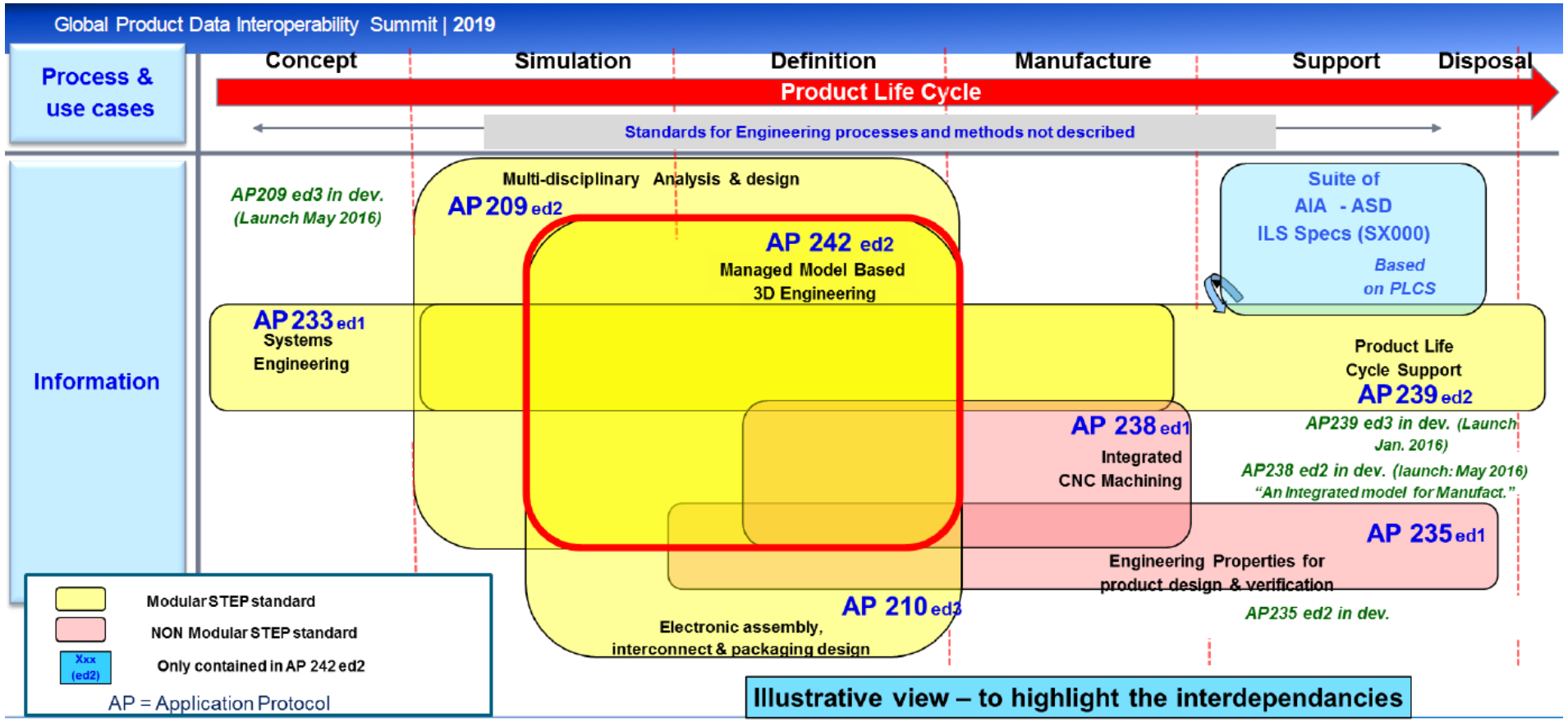
High Impact Standards-Critical MBSE Enablers



Adapted from Original Graphic: CREDIT to Bill Chown, Mentor Graphics; MBSE Roundtable, 2015 GPDIS

Overview of the key ISO 10303 STEP standards for the A&D industries

ISO 10303: Standard for the computer representation and exchange of product modeling information across the development life cycle

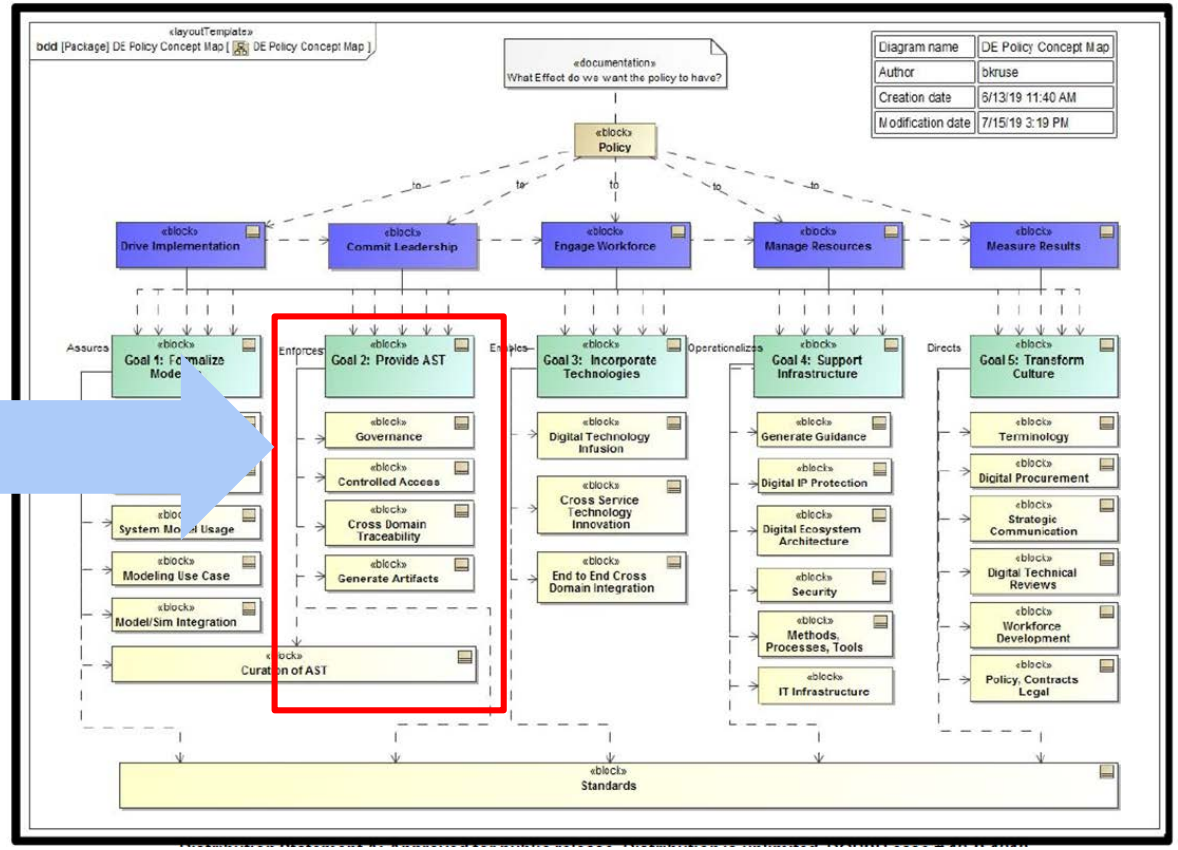


Formalize Modeling – Standards Summary

- Many MBSE modeling standards, but individual tool implementation leads to issues when exchanging modeling data
  - INCOSE and other industry working group had tested model/data exchange across different tools/platforms, most required “clean up” after import.
    - Rework needed for some even when transferring instances of the same tool
  - There are individual tool integration plug-ins to help bridge the gap, but no standards yet.
- Standard groups had established collaborating working group to harmonize the various standards and enable better interoperability.

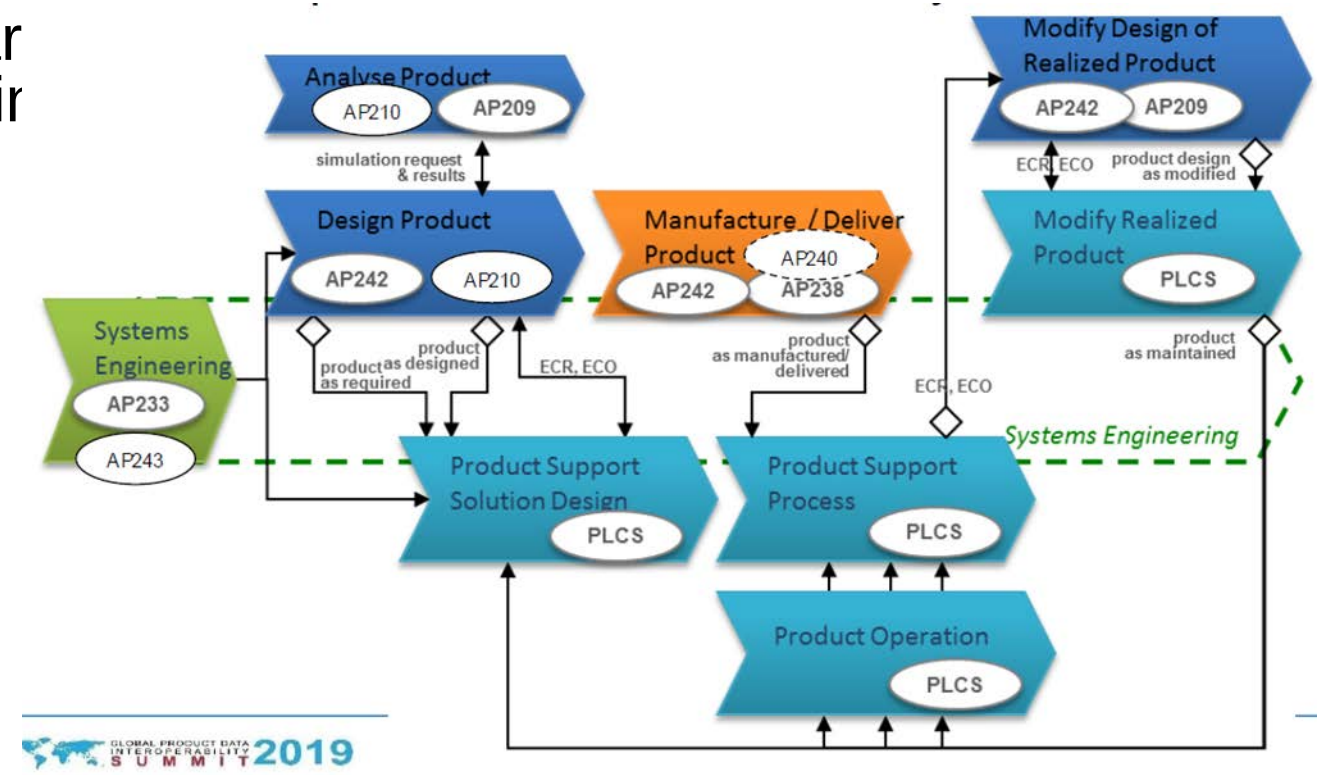
Provide AST

- Governance
- Controlled Access
- Cross-Domain Traceability
- Generate Artifacts
- Curation of AST



Provide AST – Standards Development

- Industry needs a set of complementar PLM interoperability standards coverir the full product lifecycle
- ISO 10303 provides some key standards, to be complemented by other standards
- Interoperability forms to support the development of PDM solutions with testing of COTS beta solutions.
  - PDM IF (PDM –CM) for deployment of AP242

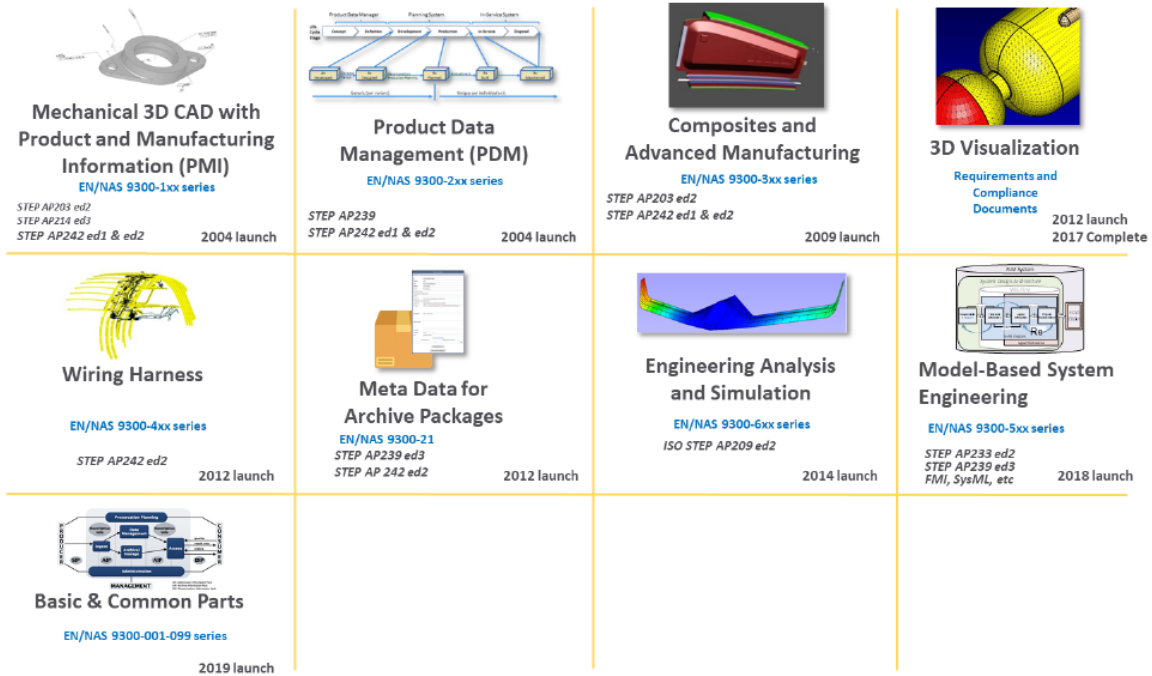


Use of ISO 10303STEP AP242 ed1 for configured MBD interoperability, GPDIS 2019

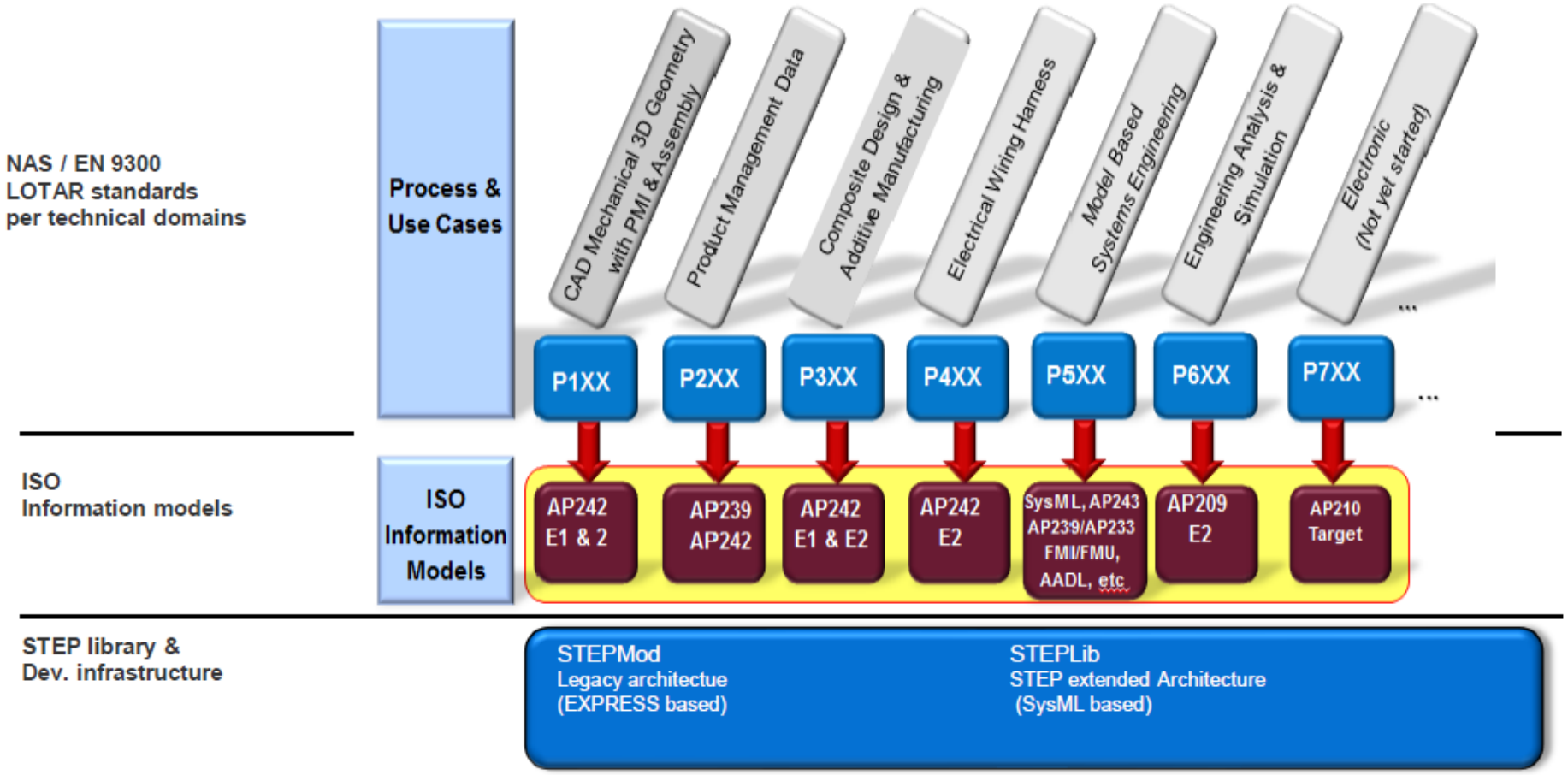
Standards for archiving and retrieving MBSE data

- The “what” and “how long” to archive is currently not standardized
  - Typically defined by the Acquirer
  - Need to archive not just the models but also the links between the models, however this is not standard practice today
- LOng Term Archiving and Retrieval (LOTAR) project:
  - Standard processes for Archive/Retrieve
  - Use standard data formats for Archive/Retrieve

LOTAR working groups

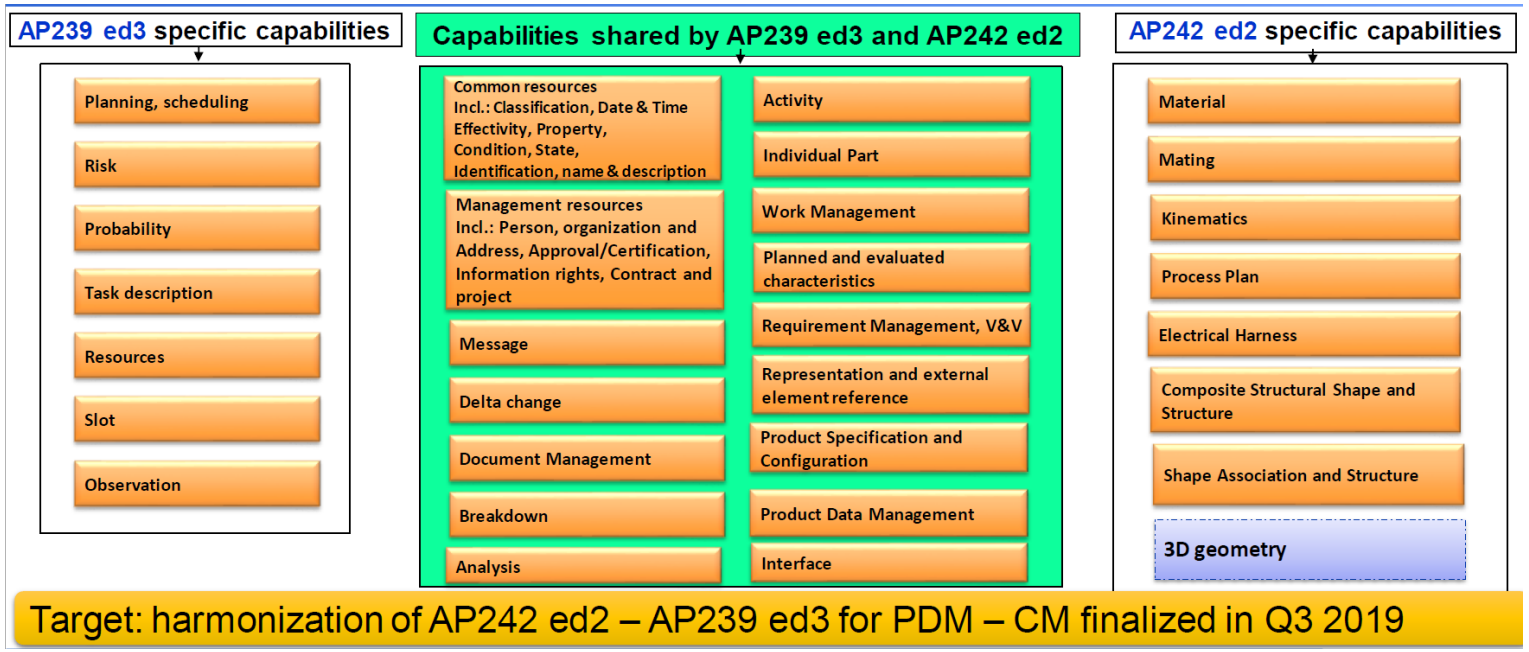


LOTAR and link to ISO standards



Provide AST – Standards Summary

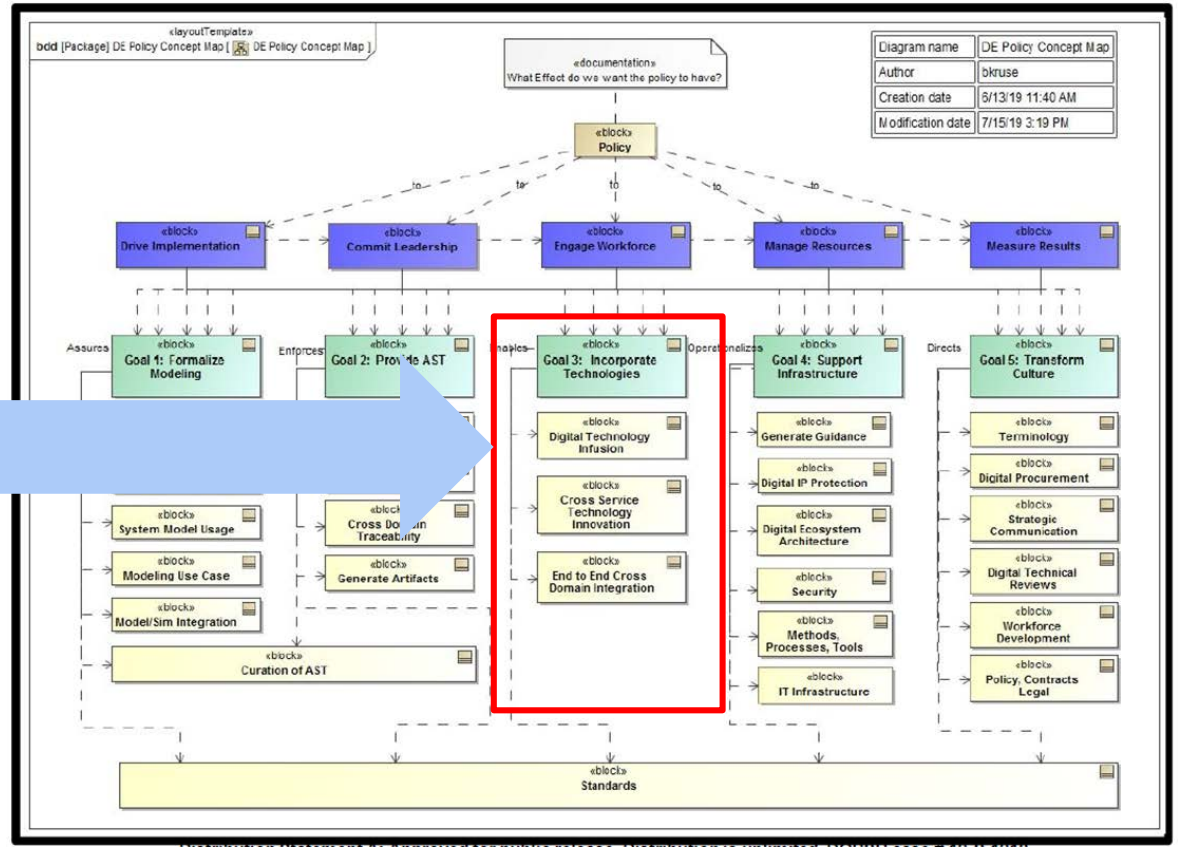
- LOTAR group is working on industry standards for archive/ retrieval
- For AST, currently most PDM system have AP242 interfaces for data exchange of “as designed” 3D models.
  - Testing underway for a PDM data exchange test case with Airbus using AP242.
  - Upcoming AP242 ed2 and AP239 ed3 will include interoperability of requirements and V&V in PDM.



From GPDS 2019

Incorporate Technologies

- Digital Technology Infusion
- Cross Service Technology Innovation
- End to End Cross Domain Integration

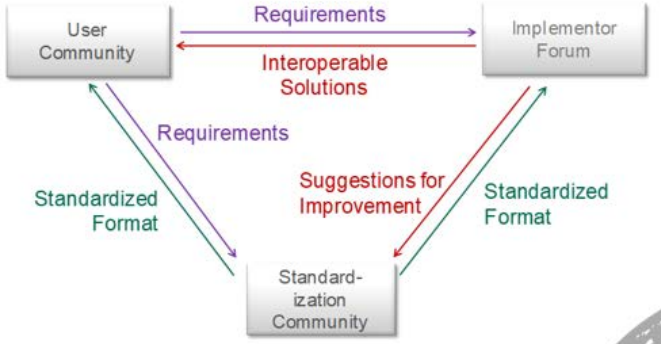


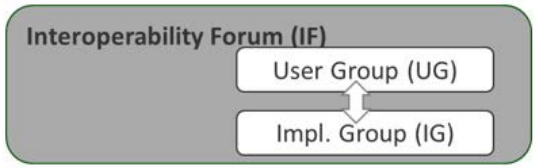
Incorporate Technologies – Standards Development

- Industry needs quick availability of open standards to help enable new technology adoptions and interoperability
  - Objective supported by ISO/TC 184/SC4 “Industrial data” chair
  - MBx Interoperability Forum set up to focus on new capabilities
- AP242 standard enhancements adopted Agile development principles to facilitate faster release cycles
  - Examples of new capabilities for AP242 5 year roadmap include:
    - Extension of electrical wiring harness to functional design, signals, etc
    - Extension for additive manufactuing, tubing, 3D PMI semantic at the assembly level, fasteners, etc
    - PDM: derogations, generic REST web services, etc

Incorporate Technologies – MBx Interoperability Forum

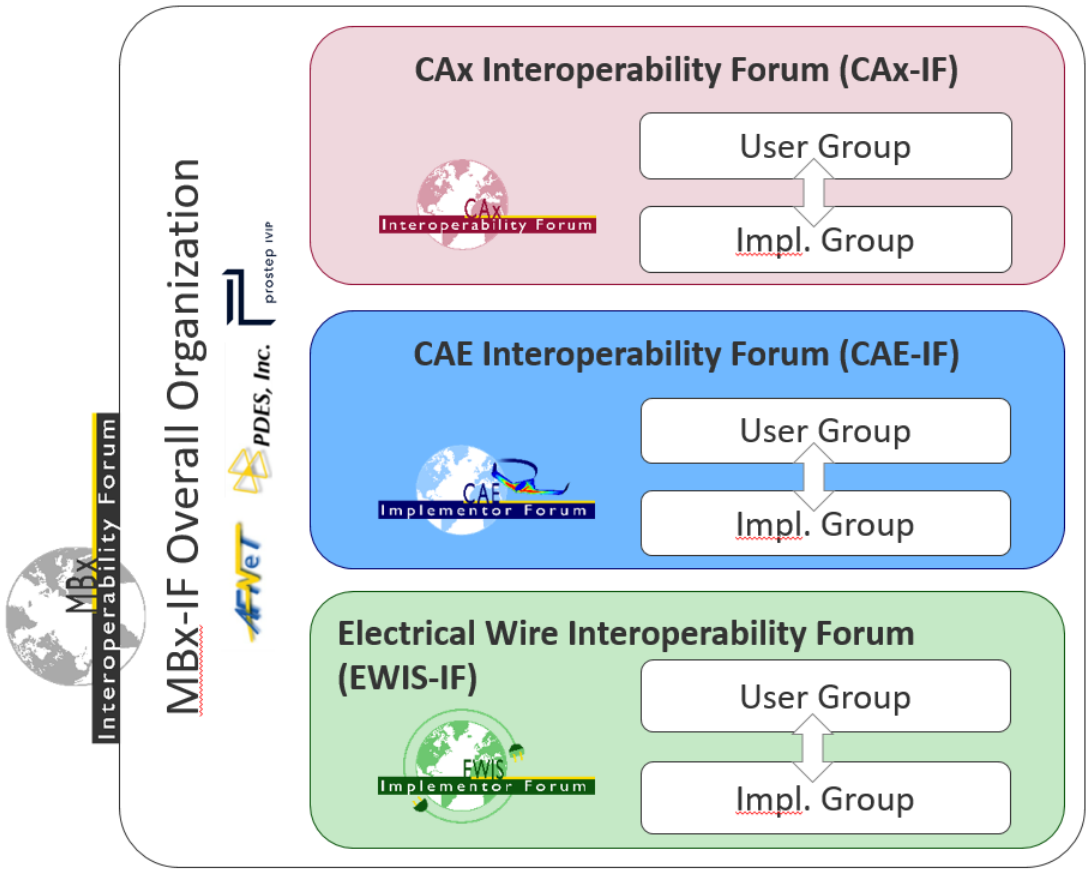
- Interoperability form set up to focus on specific capabilities of a named standards, with prioritized use cases and testing/ validation of recommended practices.
- Collaboration between AFNET, PDES, Inc., and prostep ivip

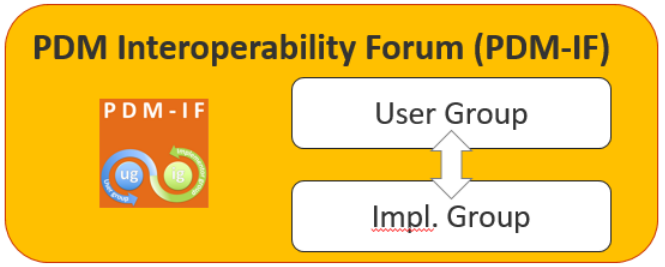




From MBx Interoperability Forum 2019

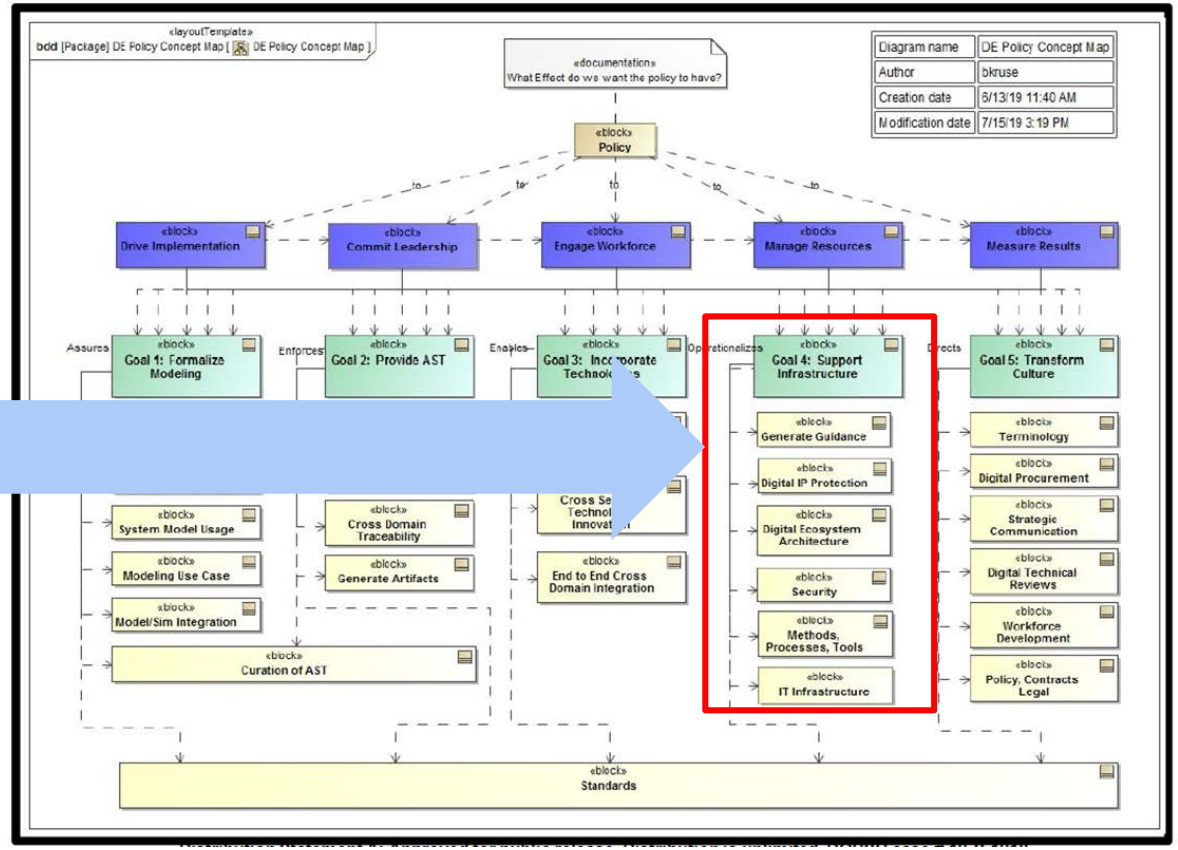
Proposed MBx-IF Project Framework





Support Infrastructure

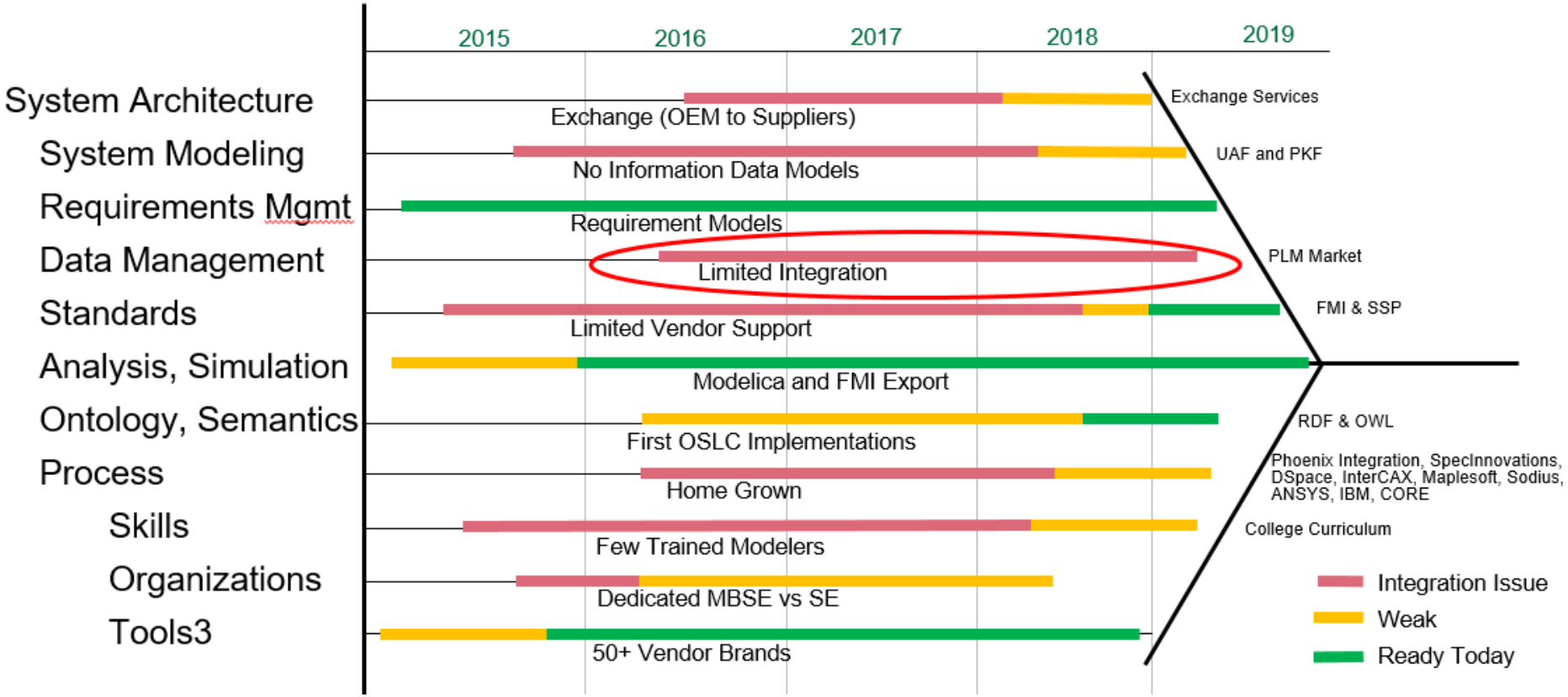
- Generate Guidance
- Digital IP Protection
- Digital Ecosystem Architecture
- Security
- Methods, Process, Tools
- IT Infrastructure



Support Infrastructure – Standards Development

- The interoperability of the IT infrastructure for product development and production is a key concern of the ongoing digital engineering environment.
  - To ascertain interoperability of tools and to avoid vendor lock-in, the tools must rely on accepted standards
- Service-oriented architectures (SOA) have shown their potential to integrate partial IT solutions along the tool-chain.
  - International standard organizations such as W3C and OMG have established widely accepted standards in this area
- The 'Open Services for Lifecycle Collaboration' (OSLC) is supported by many vendors with the goal to integrate their tools.
- There is the strong need to support a federative system approach in heterogeneous IT landscapes.
  - Better to let specialized IT solutions (e.g. PLM, ALM, ERP) communicate with each other properly instead of trying to make one solution obsolete by obtaining its functionality.

Industry Roadmap: From Global Product Data Interoperability Summit 2019

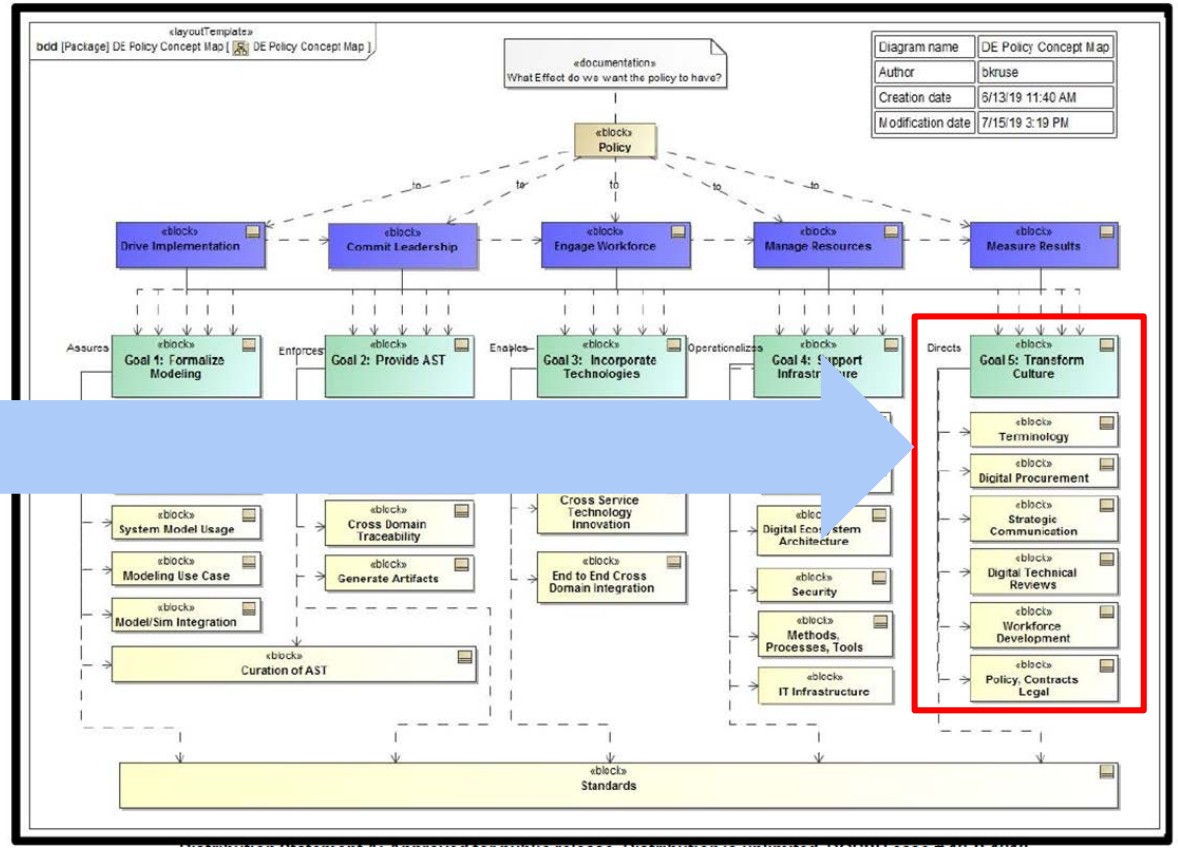


Support Infrastructure – Challenge and Opportunities

- Data scalability for the MBSE cloud server is necessary and often overlooked
  - The overall performance of the data servers relates inversely with the size of the project and the number of concurrent users on the server.
- Key opportunities:
  - Explore ways to decrease the time spent migrating between server environments
  - Address performance issues in the production environment due to project sizes

Transform Culture

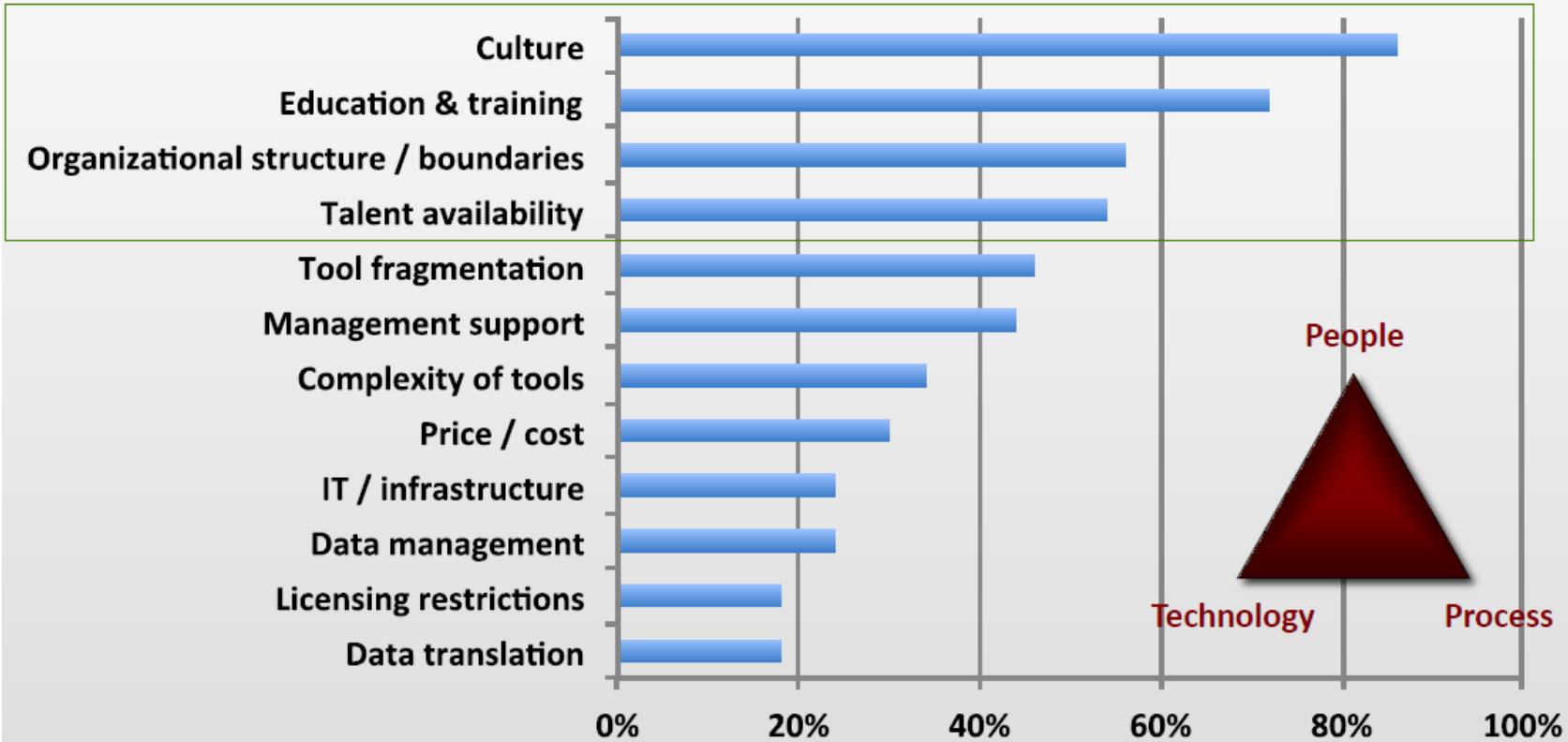
- Terminology
- Digital Procurement
- Strategic Communication
- Digital Technical Reviews
- Workforce Development
- Policy, Contracts, Legal



Barriers to Industry Implementation

What users cited as problems to overcome in adopting & using MBE/MBSE

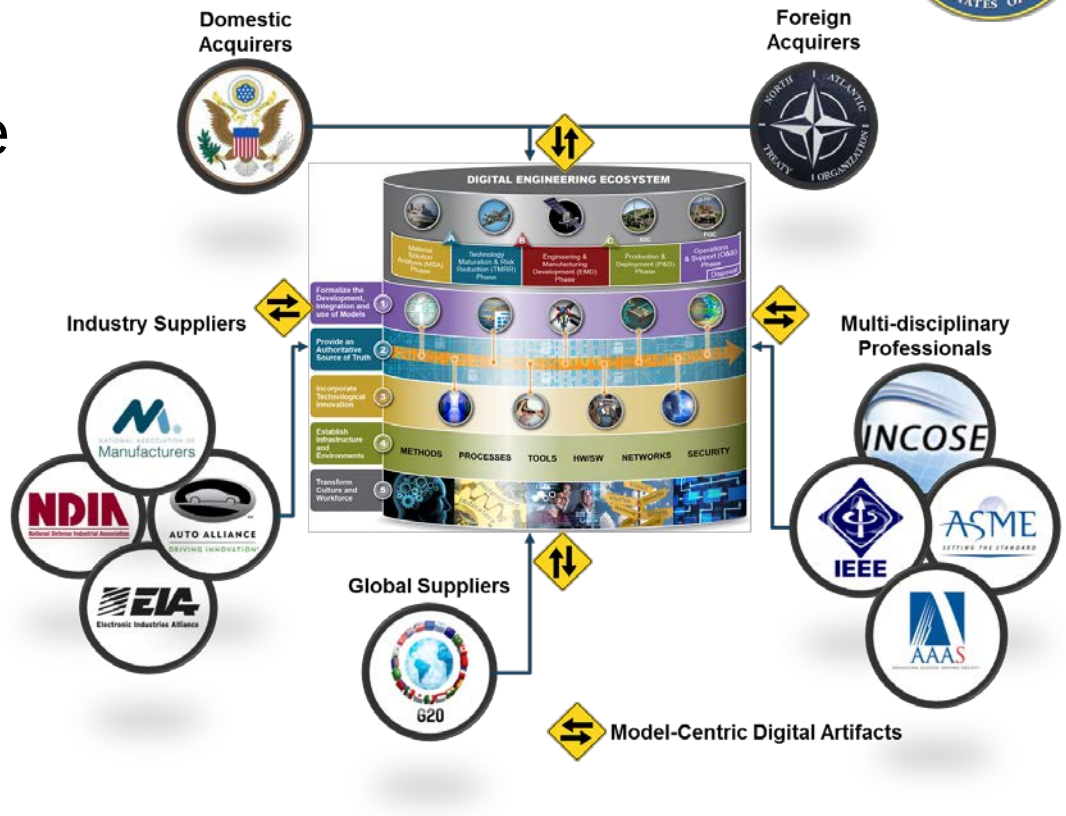
- It is about people & process as well—not just technology



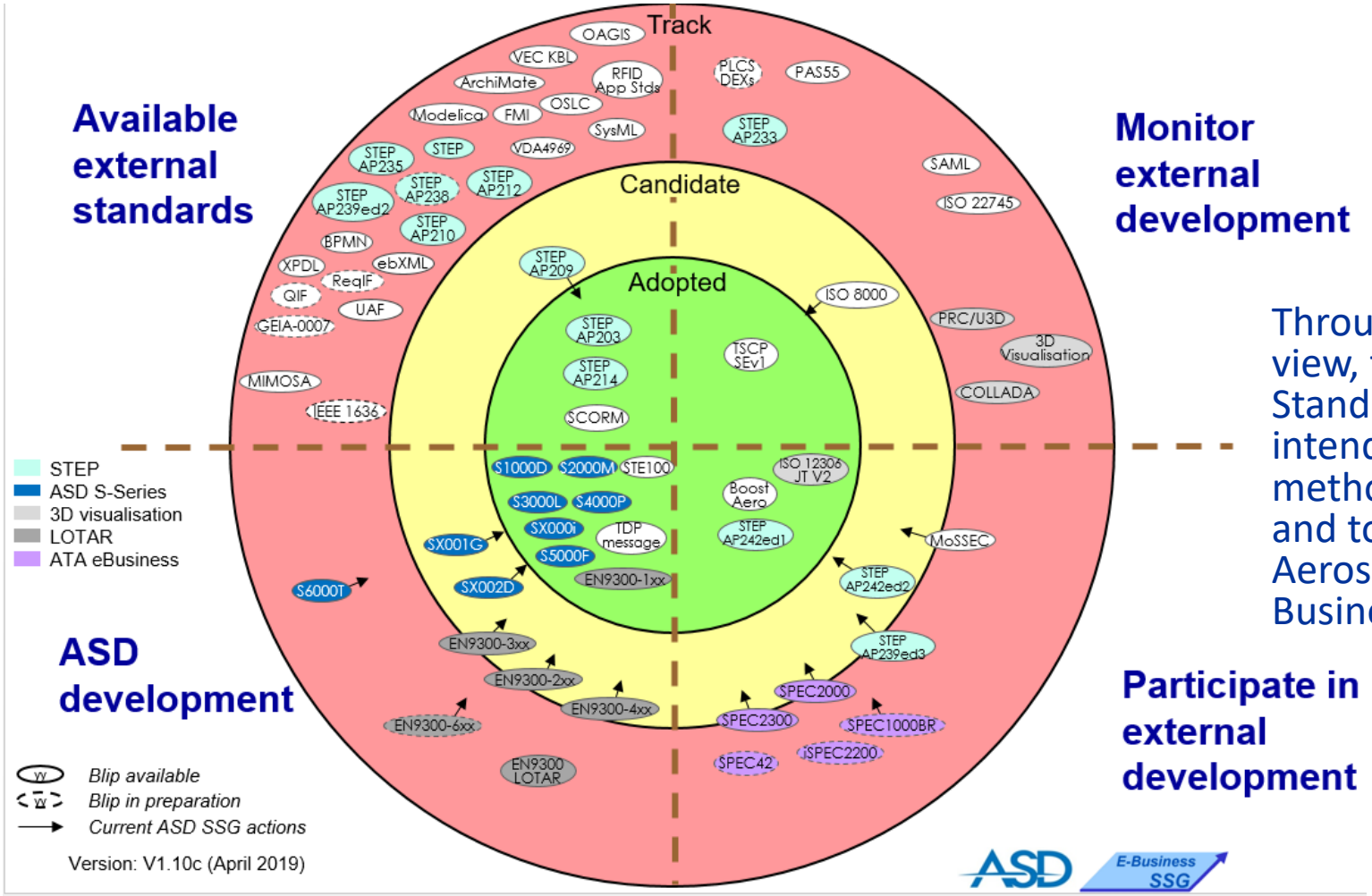
Source: CIMdata MBSE web survey conducted with ANSYS & INCOSE (2015)

Transform Culture – Standards Development

- Various standards working groups are prioritizing MBSE use cases to identify future standard updates
  - Generating guidance for standard adoptions and best practices
  - INCOSE DEIX WG is currently working to define the data exchange necessary for conducting Digital Technical Reviews.



ASD Industry View of Standards Universe



Through this synthesis view, the SSG (Strategic Standardisation Group) intends to build on the methods developed by AIA and to develop a common Aerospace view on e-Business Standards.

Final Thoughts

- Open standards will be critical to achieving Digital Thread(s)
- The largest challenge facing MBSE at the moment is interoperability between different platforms. This is an ongoing issue.
- OEMs need to understand that they are asking suppliers to make a paradigm shift
  - *Industry & DoD need to support new contractual concepts AND accept electronic project deliverables/TDPs/signoffs vs paper/documents*
- How do we standardize and/or modernize the systems engineering architecting and deployment process at a large company filled with legacy tools, practices and ideas?
  - What should we keep, and what should we reconsider?

Back up