GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2024

Pain Points in Collaboration between Aerospace OEM's and partners

Kyle Hall - Airbus
Bernd Feldvoss - Airbus

Presenters Bio

Kyle Hall
Data Driven System Engineer

Engineering Methods

AIRBUS

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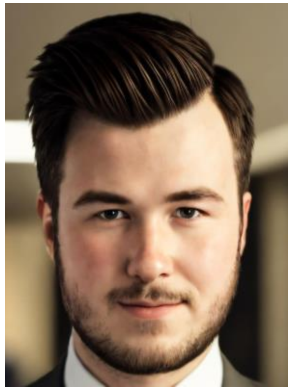

Kyle Hall is a Data Driven System Engineer within Airbus Commercial Aircraft, based in Filton (Bristol), UK

Kyle graduated from the University of Bristol, majoring in Physics. Kyle joined Airbus in 2016, supporting the development of rapid and scalable surrogate modelling techniques and the MoSSEC common metadata standard (ISO 10303-243), eventually becoming the MoSSEC project lead in 2022.

Today Kyle is a key member of the Airbus transdisciplinary Engineering Methods team, maturing and supporting the implementation of many new and innovative methodologies for Airbus' varied portfolio.

Presenters Bio

Bernd Feldvoss
PLM Interoperability Standards Specialist

Engineering Tools Architecture and Roadmap

AIRBUS

Bernd.Feldvoss@airbus.com

Bernd Feldvoss is a Product Data Interoperability Standards Specialist within Airbus Commercial Aircraft, based in Hamburg, Germany.

Bernd joined Airbus in 1998 and worked as a Systems Engineer where he was involved in the development of Data Exchange Methods and operating Data Exchange (DMU & Product Structure) and did several movements until joining in 2022 engineering Process, Methods, Tools & Data.

Bernd represents Airbus in numerous working groups and committees including; prostep ivip Technical Steering Committee and the JT Open Technical Review Board. He is also a member of the Global Collaboration Working Group in the CIMdata managed PLM Aerospace & Defense Action Group.

Bernd studied Computer Science at the University of Hamburg, where his focus was on Computer Aided Engineering.

Agenda

1 **Build to print**

How did we collaborate?

2 **Transition**

How did we transition into the digital age?

3 **Protection**

How do we manage our responsibilities?

4 **Mindset Change**

Introducing a collaboration framework

5 **Standards**

To support collaboration

1. Historically - How did we typically collaborate with our partners? A example development lifecycle

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2. The concept is matured through documentation sharing within the OEM.
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Remains the same

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We may now use models to mature a concept - however are the models truly interoperable in our organizations?

Interoperable Tools, Interoperable Interfaces, Interoperable Languages, Interoperable Understanding?

What usually happens is abstraction of the knowledge is summarised in documentation to be shared within the organization (emails, technical docs, memos, PowerPoints, etc.)

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Is an NDA sufficient anymore?

IP Protection / Obfuscation and Export Control considerations need to be assured

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Disparate information overload makes overall product Multi-Disciplinary Analysis and Optimisation (MDAO) still not a reality for most in 2024

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Do we keep trace of the rationale behind these recommendations?
How do we know the context of a recommendation is valid for the given purpose?
Could we be missing something? - especially in a more complex space

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Following on, can the project owner comprehend the full picture?
Without the decision traceability who is accountable for the overall design?

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This is not resulting in meaningful collaboration.
This is optimization of a set product definition, built upon digital documents.

Evolved *Remains the same*

3. How do we manage our responsibilities?

1. There are **multiple concepts** to be **evaluated** - *an NDA is reached with a partner and the project is*

The partner has a key interest in satisfying the OEM and managing internal factors (cost, time, etc.)

Decisions made in the earlier stages of the design by the OEM could have better satisfied both parties.

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Who owns the design and is responsible for any decisions made?

New concepts in these OEM/Partner design reviews can constitute knowledge exports from each organization? How is this managed?

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3. How do we manage our responsibilities?

There are three key recurring pain points in any project and especially when dealing with partners:

- **Complexity**
- **IP Protection**
- **Export Control**

underlined, crucially by missing:

- **Traceability of intangible assets**

Our potential is limited fundamentally by the lack of traceability of our intangible assets.

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Collaboration Frameworks

There are **multiple axes** to be taken into account to deal with the collaboration between partners:

- Type of supplier connection (e.g. risk sharing partner, build-2-print supplier, raw material provider, etc.)
- Coverage and scope of collaboration (engineering, manufacturing, etc.)

Challenge:

Each OEM defines their own definition of collaboration and methodology.

The **Unified Architecture Framework**® (UAF®) is based on the Unified Modeling Language™ (UML®), Systems Modeling Language™ (SysML®), the Unified Profile for the U.S. **Department of Defense's Architecture Framework** (DoDAF) and the U.K.'s **Ministry of Defence's Architecture Framework** (MoDAF™) (UPDM™) and the **North Atlantic Treaty Organization**'s (NATO) **Architecture Framework** (NAF). When these military requirements were combined with business sector requirements (90% of concepts and themes captured in the military frameworks are equally applicable in the commercial domains), the UAF was born which serves both commercial and military interests.

Participants include a broad spectrum of parties covering industry, tool vendors, end users and representatives of the DoD, MoD, and NATO.

UAF defines ways of representing an enterprise architecture that enables stakeholders to focus on specific areas of interest in the enterprise while retaining sight of the big picture. UAF meets the specific business, operational and systems-of-systems integration needs of commercial and industrial enterprises as well as defense organizations.

UAF® OMG UNIFIED ARCHITECTURE FRAMEWORK®

The **Unified Architecture Framewor**k® (UAF®) is based on the Unified Modeling Language™ (UML®), Systems Modeling Language™ (SysML®), the Unified Profile for the U.S. Department of Defense's Architecture Framework (DoDAF) and the U.K.'s Ministry of Defence's Architecture Framework (MoDAF™) (UPDM™) and the North Atlantic Treaty Organization's (NATO) Architecture Framework (NAF). When these military requirements were combined with business sector requirements (90% of concepts and themes captured in the military frameworks are equally applicable in the commercial domains), the UAF was born which serves both commercial and military interests.

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UAF Summit 2024 Agenda

UAF® OMG UNIFIED ARCHITECTURE FRAMEWORK®

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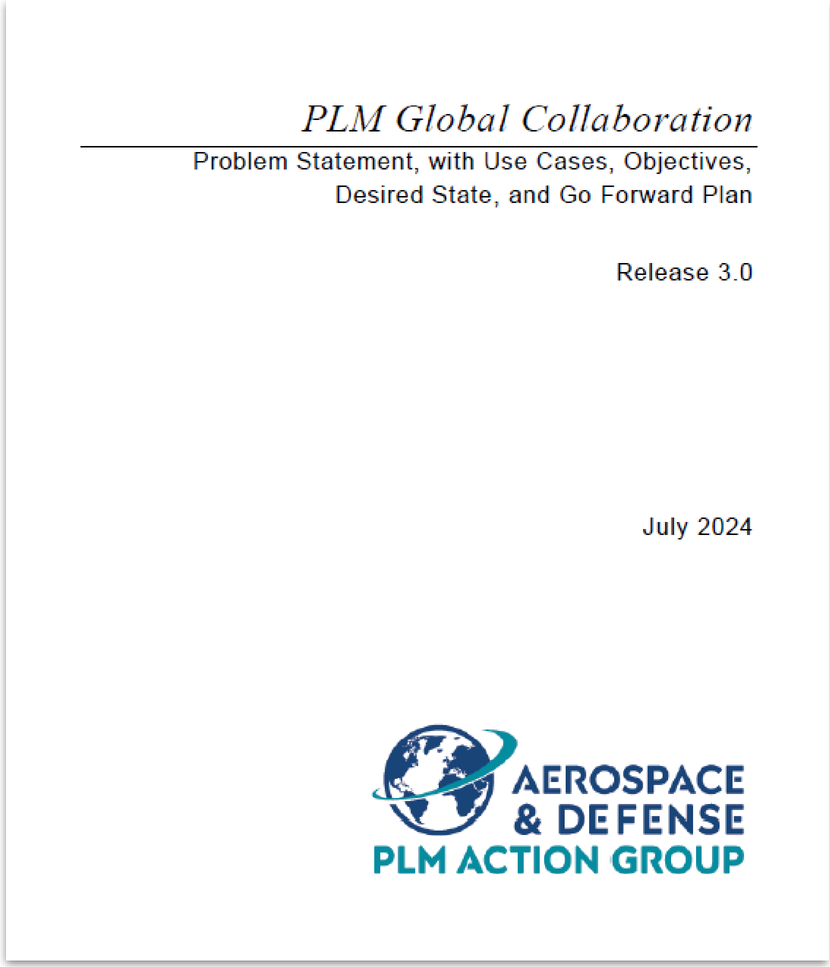
PLM Global Collaboration

Problem Statement, with Use Cases, Objectives, Desired State, and Go Forward Plan

Release 3.0

July 2024

AEROSPACE & DEFENSE PLM ACTION GROUP

AEROSPACE & DEFENSE PLM ACTION GROUP

Members

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GE Aerospace

Gulfstream
A GENERAL DYNAMICS COMPANY

PRATT & WHITNEY
DEPENDABLE ENGINES

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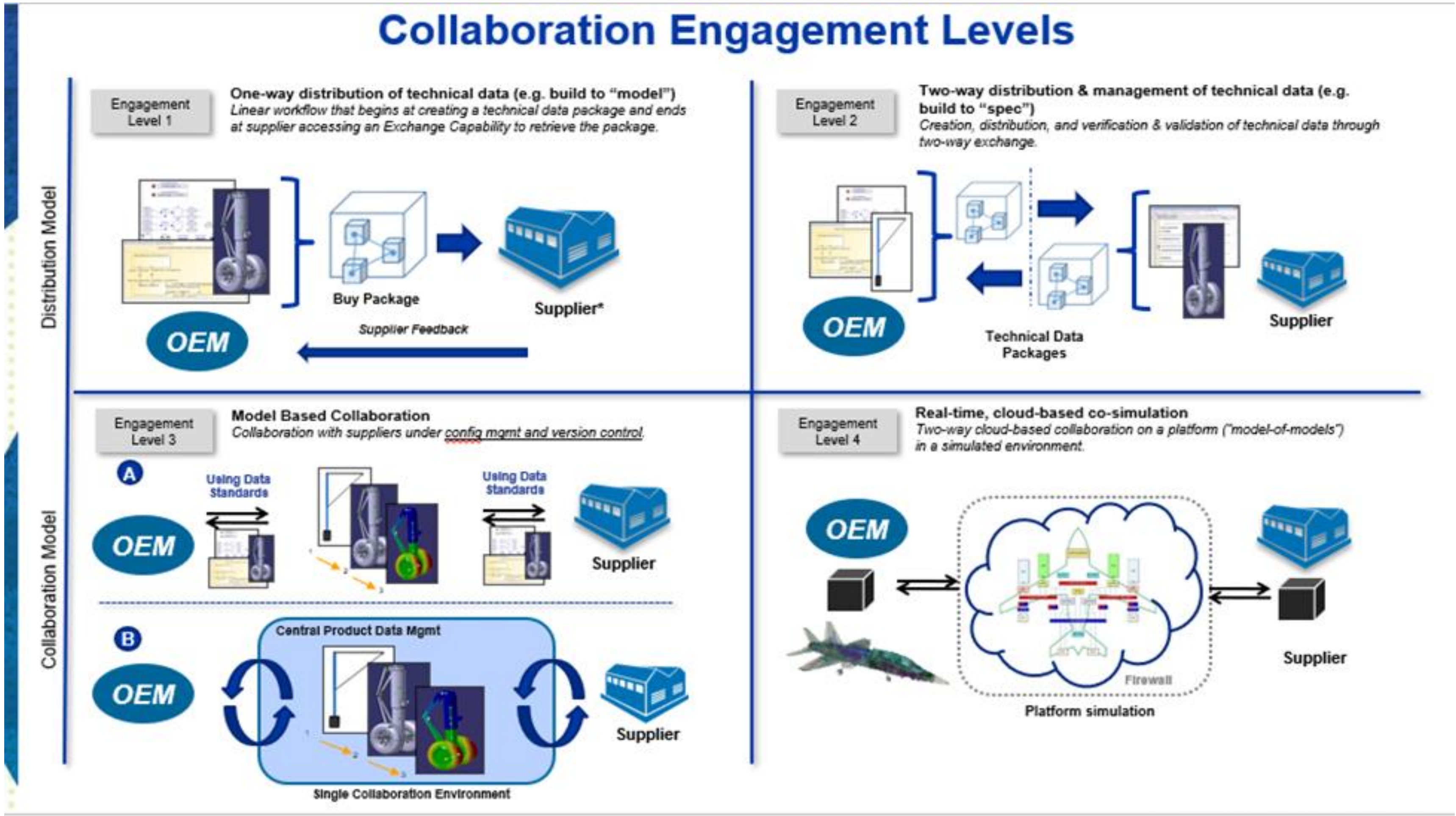
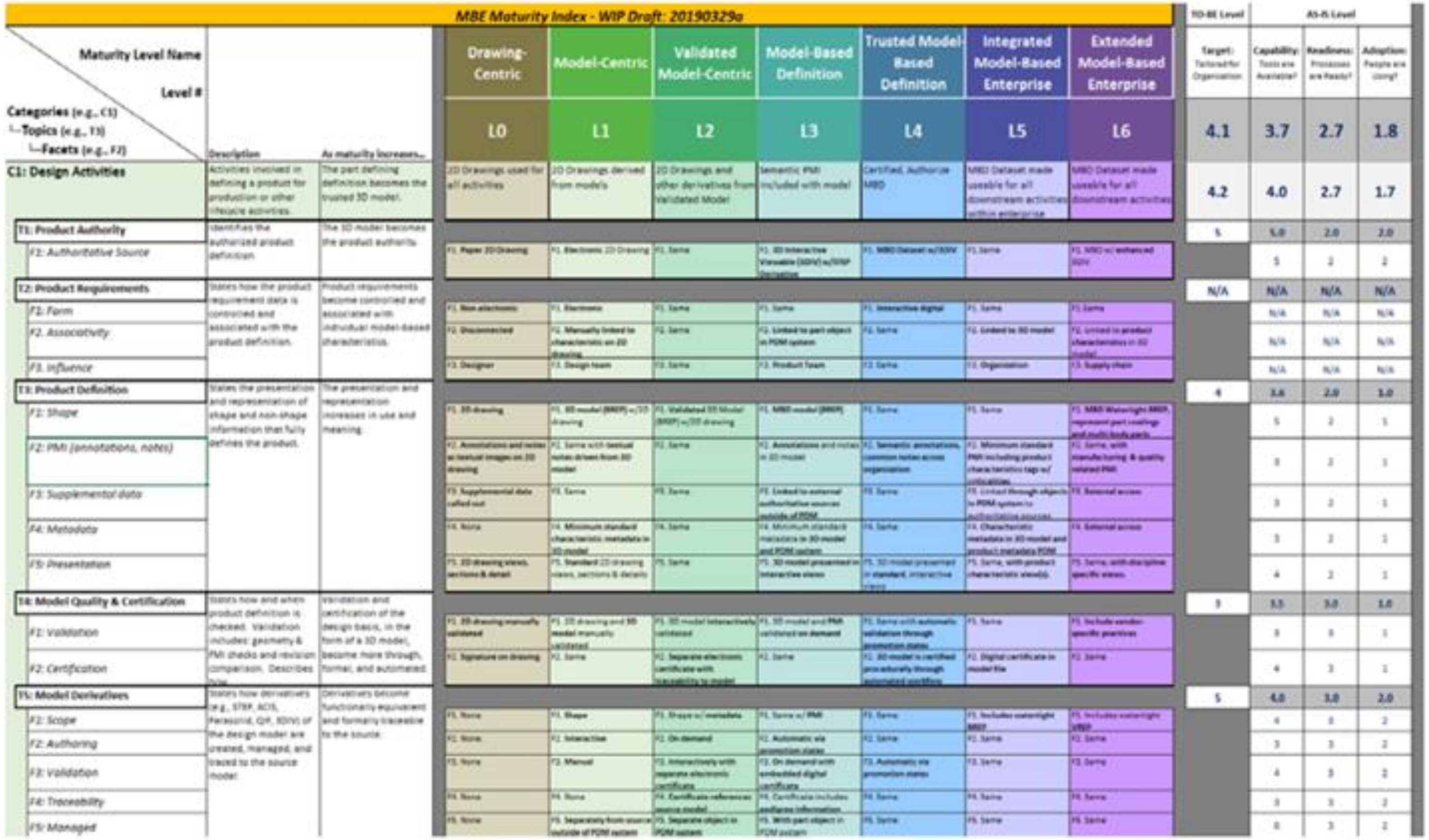
SPIRIT AEROSYSTEMS

Aerospace & Defense PLM Action Group - Supplier Engagement Levels



Sandia National Laboratories - Model Based Enterprise (MBE)

Sandia National Laboratories has published a **Model-Based Enterprise** (MBE) Maturity Level Index, which is available at [MBE Maturity Index Issue]



The MBE Summit has brought academia, government, and industry experts together for over 10 years to share the challenges, implementation issues, and lessons learned in design, manufacturing, quality assurance, and sustainment of products and processes where a Model-Based approach is used. This includes all aspects of the product lifecycle from design, manufacturing, quality assurance, and sustainment of products, where a digital 3D model acts as the authoritative source of information.

Topics included:

- Addressing gaps that exist even in closely related domains
- The role standards play in governing core requirements, best practices, and harmonization between common MBD formats (such as STEP and QIF) to enable valuable information to recirculate for optimal refinement and traceability required for long-term archival
- MBE Standards and challenges to reaching consensus on content and data elements to compensate for use cases not yet addressed in a standard
- Technical Data for Design, Manufacturing, and Quality
- Ingestion of Technical Data and User Requirements
- Digital Thread Initiatives
- Implementation Roadblocks and Progress towards MBE

Agenda 2024

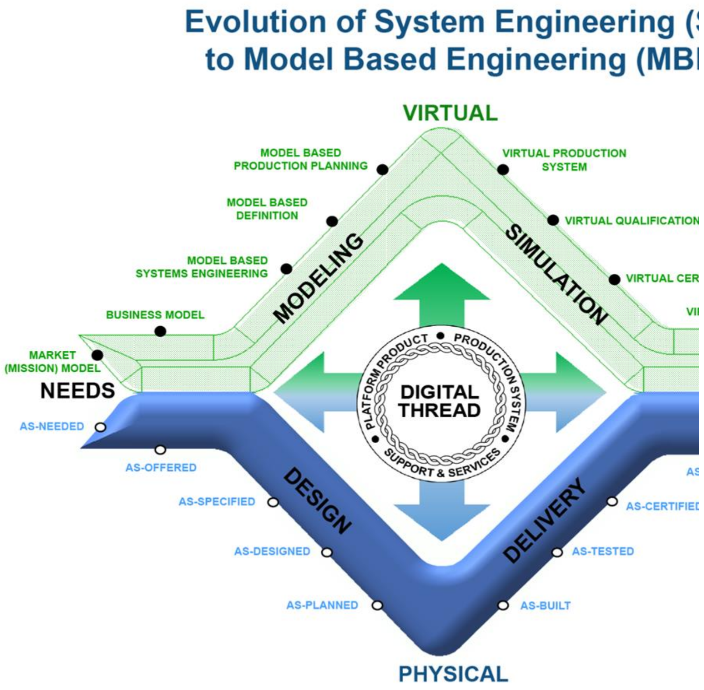
NIST DMSC MBE QIF Summit @ MxD

April 15-17, 2025

Example - Boeing Supplier Integration

Model Based Engineering (MBE)

Boeing Model Based Engagement Framework



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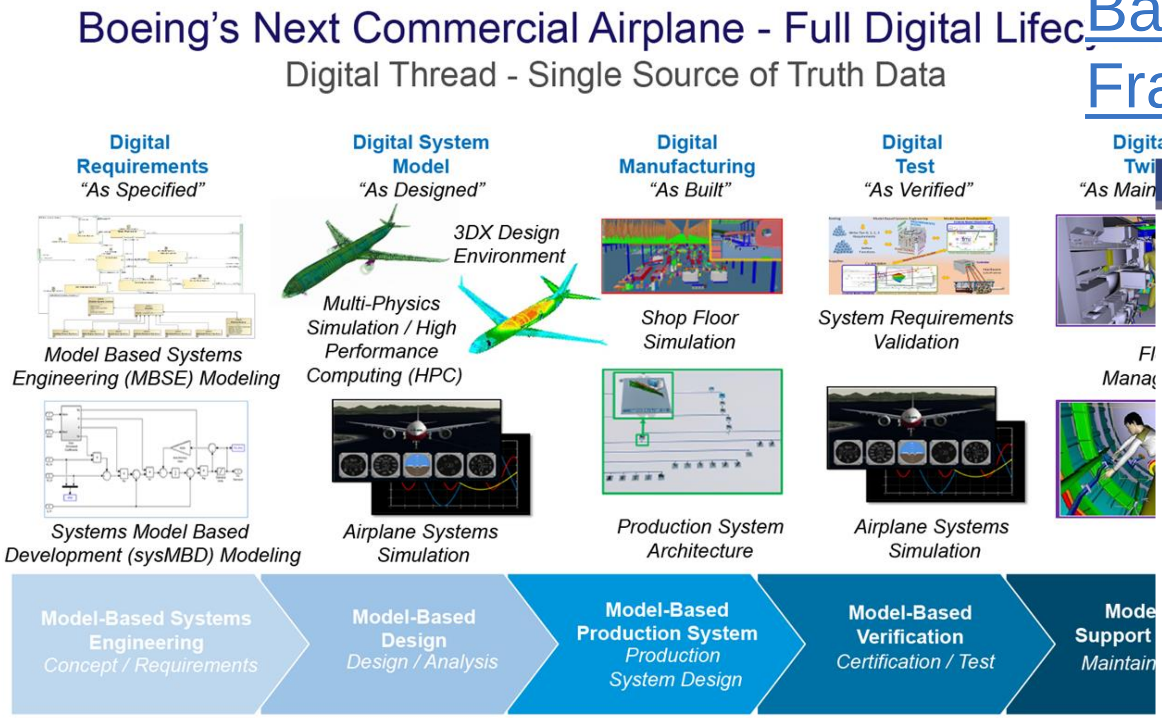
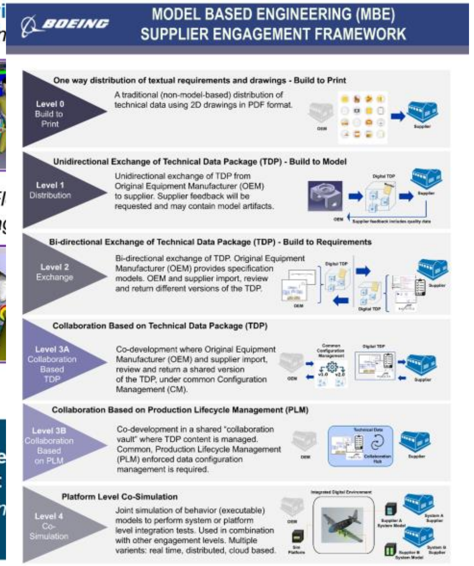


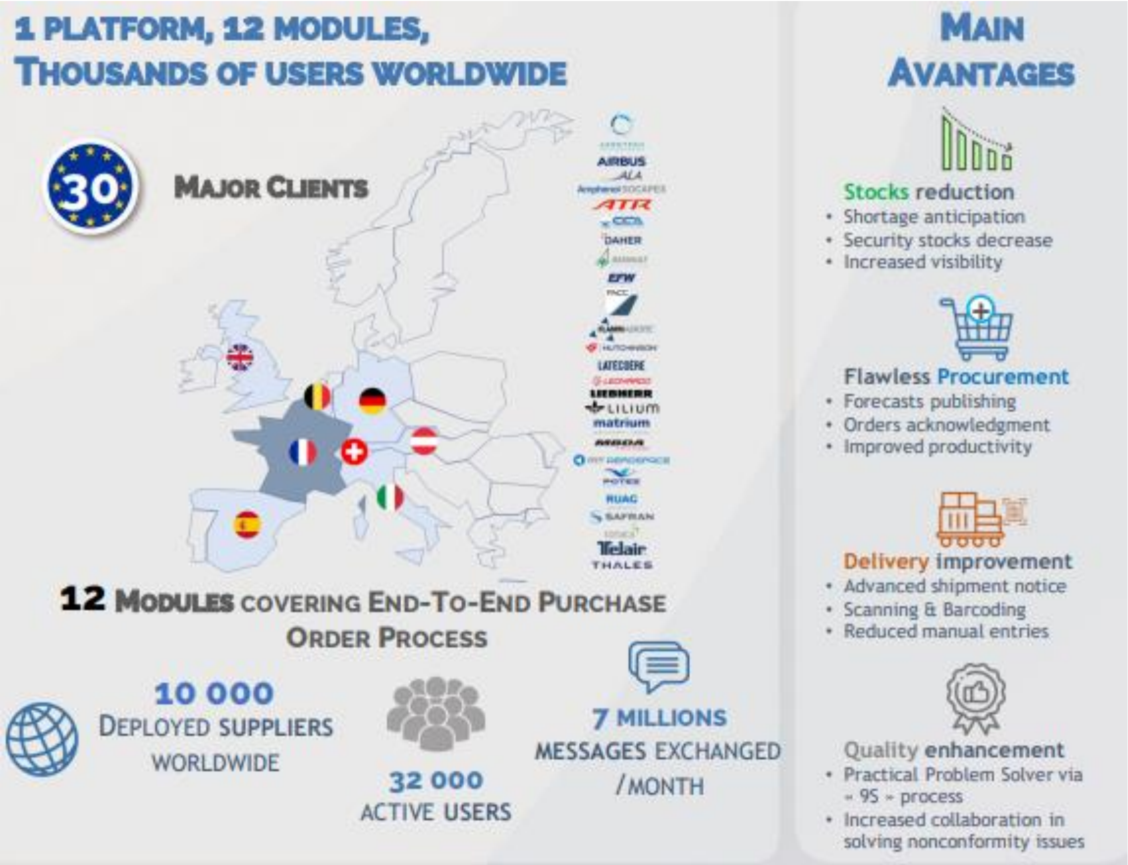


Example - Lockheed Martin Supplier Collaboration

MBE Playbook for Supply Chain

Example - AirSupply in Europe

AirSupply is a single supply chain solution for direct procurement shared by the main European aerospace companies within the BoostAeroSpace hub.



AirSupply

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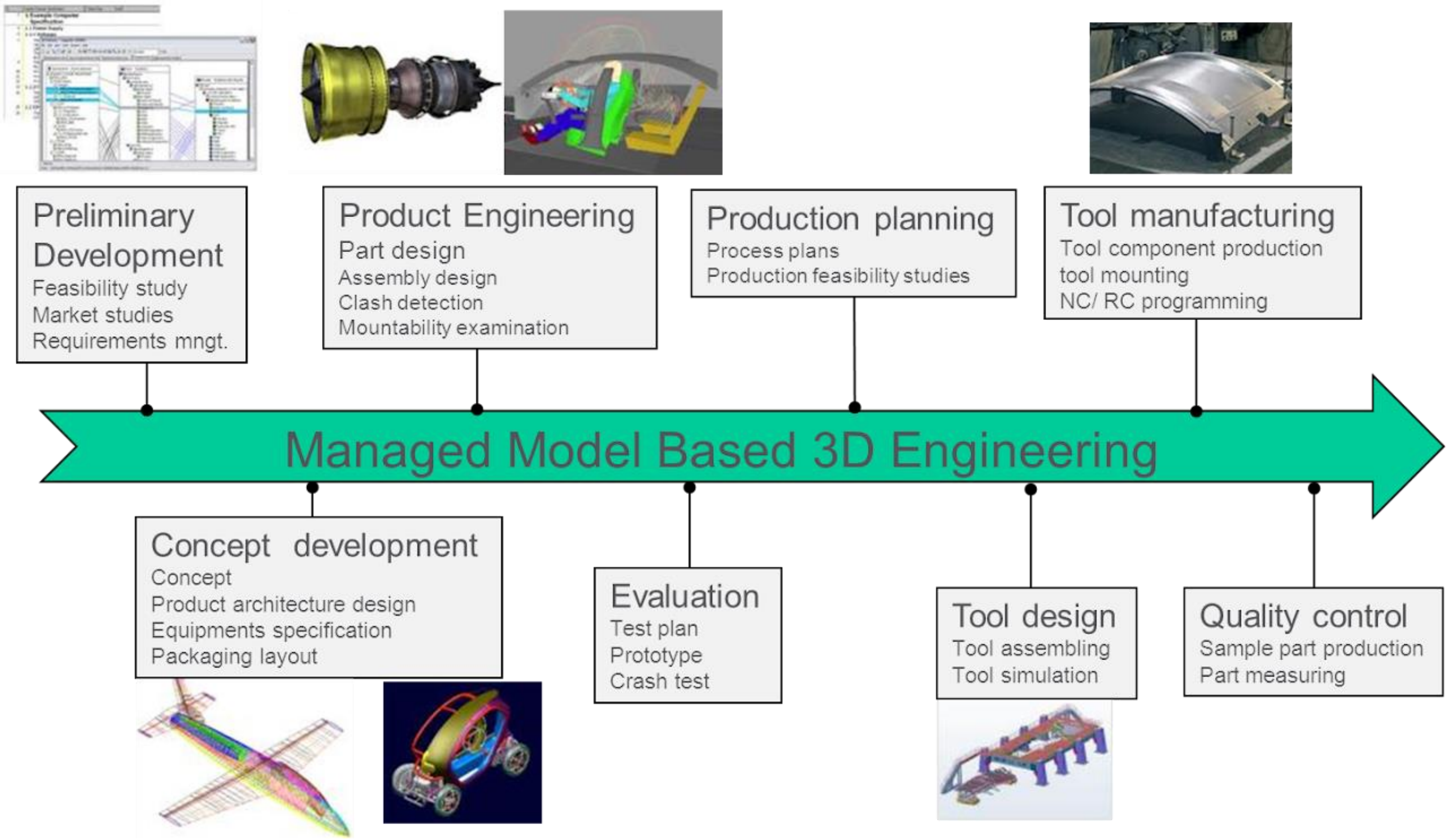
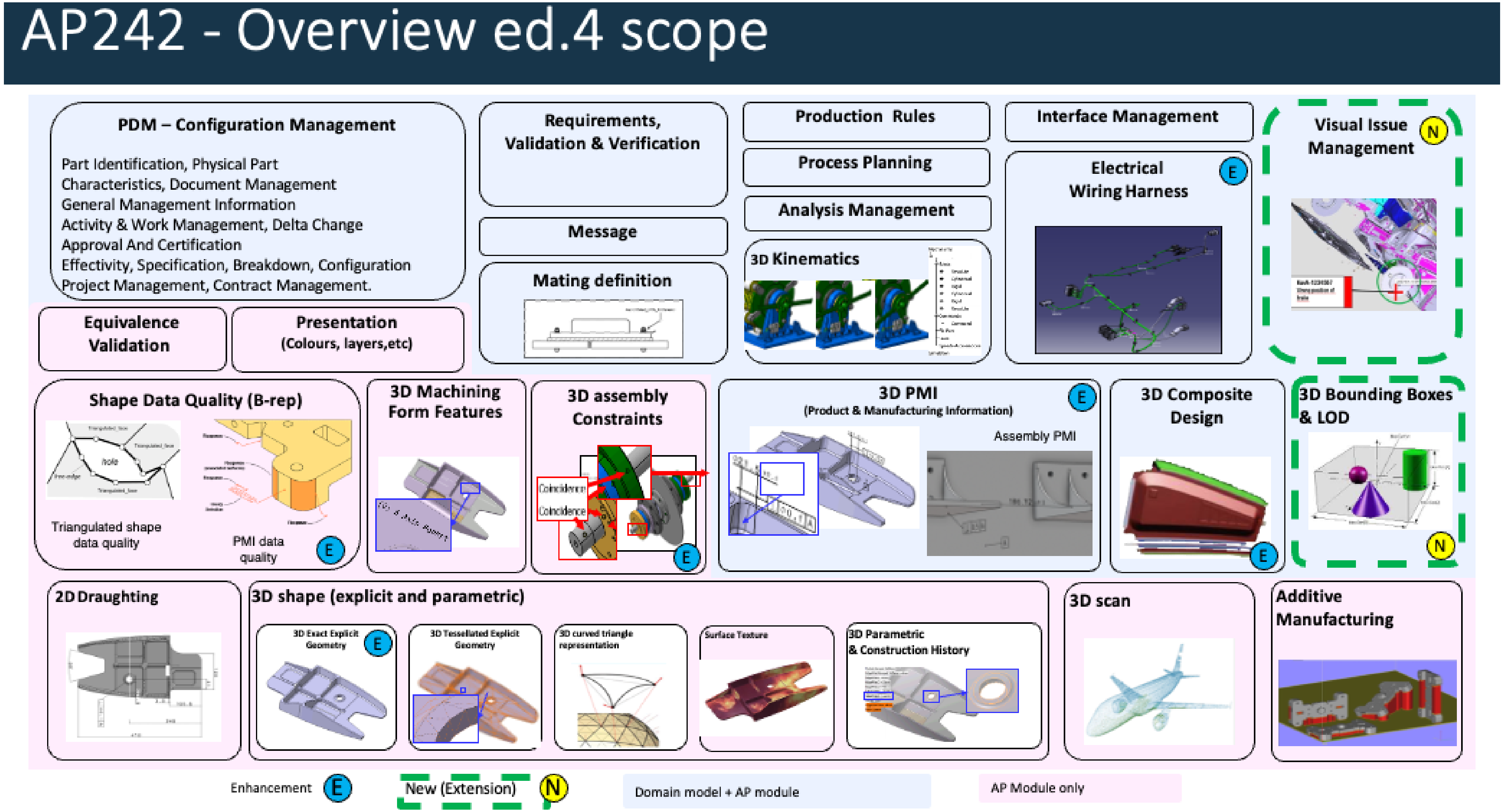
Standards STEP AP242 : Managed model based 3D engineering





AP242 - Overview ed.4 scope
PDM – Configuration Management
Part Identification, Physical Part Characteristics, Document Management General Management Information Activity & Work Management, Delta Change Approval And Certification Effectivity, Specification, Breakdown, Configuration Project Management, Contract Management.
Requirements, Validation & Verification
Message
Mating definition
Production Rules
Process Planning
Analysis Management
3D Kinematics
Interface Management
Electrical Wiring Harness
E
Visual Issue Management
N
Equivalence Validation
Presentation (Colours, layers,etc)
Shape Data Quality (B-rep)
Triangulated shape data quality
PMI data quality
E
3D Machining Form Features
3D assembly Constraints
Coincidence
Coincidence
E
3D PMI
(Product & Manufacturing Information)
Assembly PMI
E
3D Composite Design
E
3D Bounding Boxes & LOD
N
2D Draughting
3D shape (explicit and parametric)
3D Exact Explicit Geometry
E
3D Tessellated Explicit Geometry
3D curved triangle representation
Surface Texture
3D Parametric & Construction History
3D scan
Additive Manufacturing
Enhancement
E
New (Extension)
N
Domain model + AP module
AP Module only

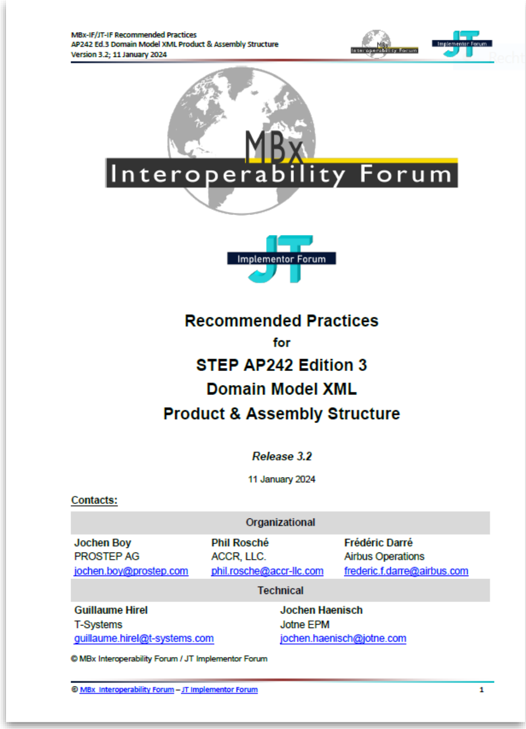
MBx Interoperability Forum

Global Product Data Interoperability Summit | **2024**

MBx IF

Recommended Practices

- CAx IF
- PDM IF
- EWIS IF



MBx-IF/JT-IF Recommended Practices
AP242 Ed.3 Domain Model XML Product & Assembly Structure
Version 3.2; 11 January 2024

Recommended Practices
for
STEP AP242 Edition 3
Domain Model XML
Product & Assembly Structure

Release 3.2

11 January 2024

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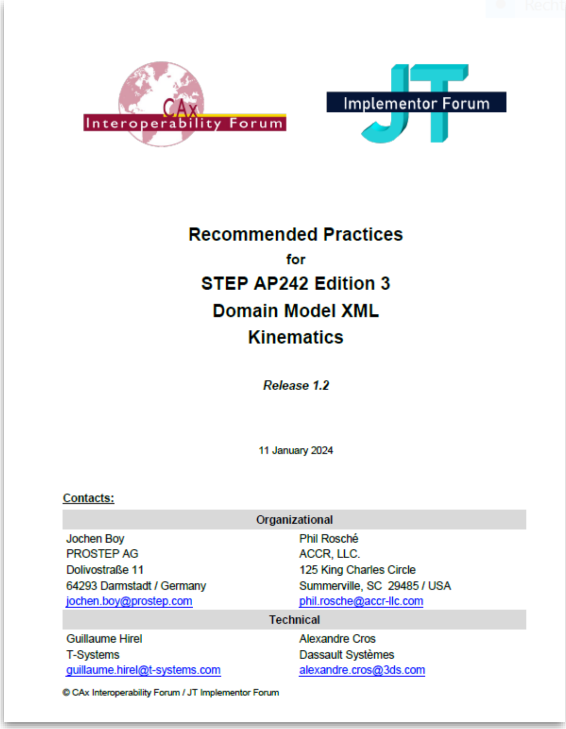

Recommended Practices
for
STEP AP242 Edition 3
Domain Model XML
Kinematics

Release 1.2

11 January 2024

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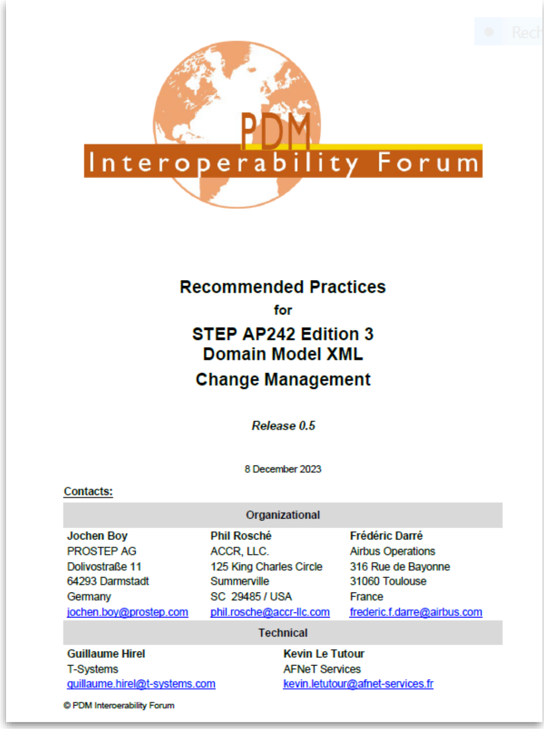

Recommended Practices
for
STEP AP242 Edition 3
Domain Model XML
Change Management

Release 0.5

8 December 2023

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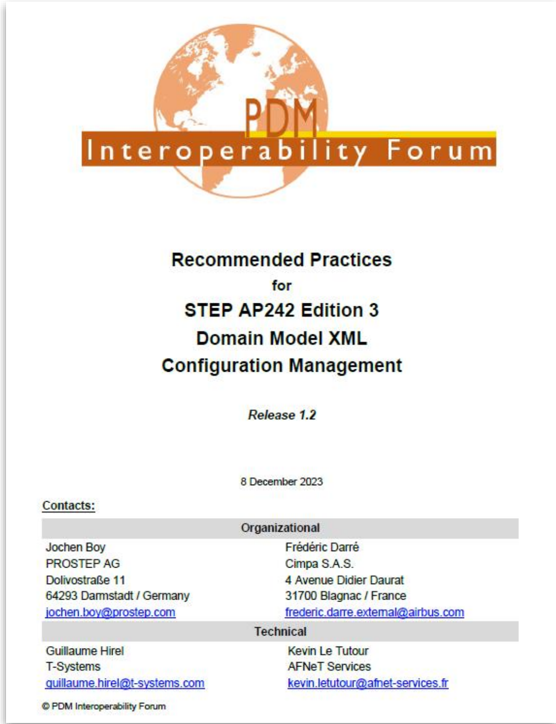

Recommended Practices
for
STEP AP242 Edition 3
Domain Model XML
Configuration Management

Release 1.2

8 December 2023

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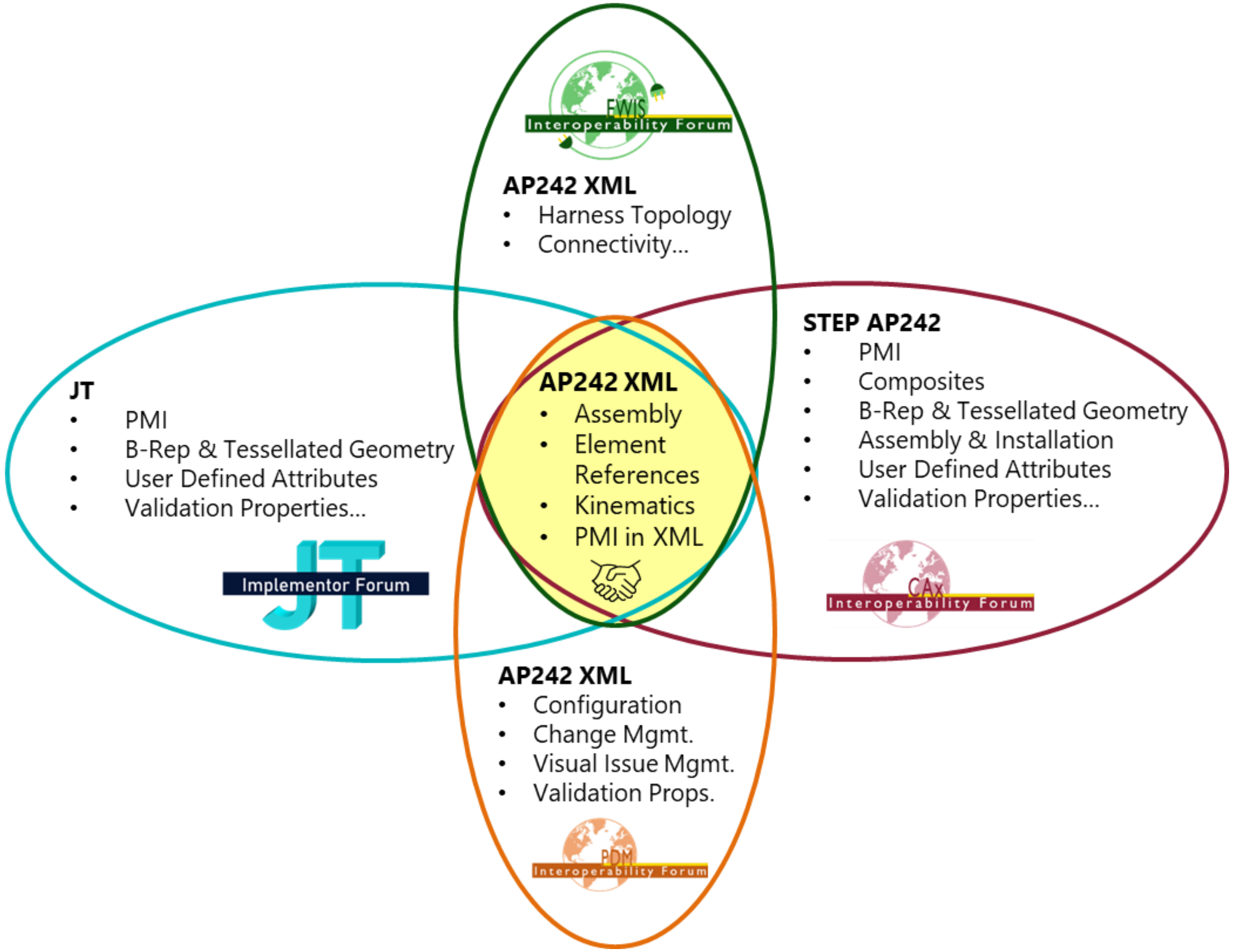
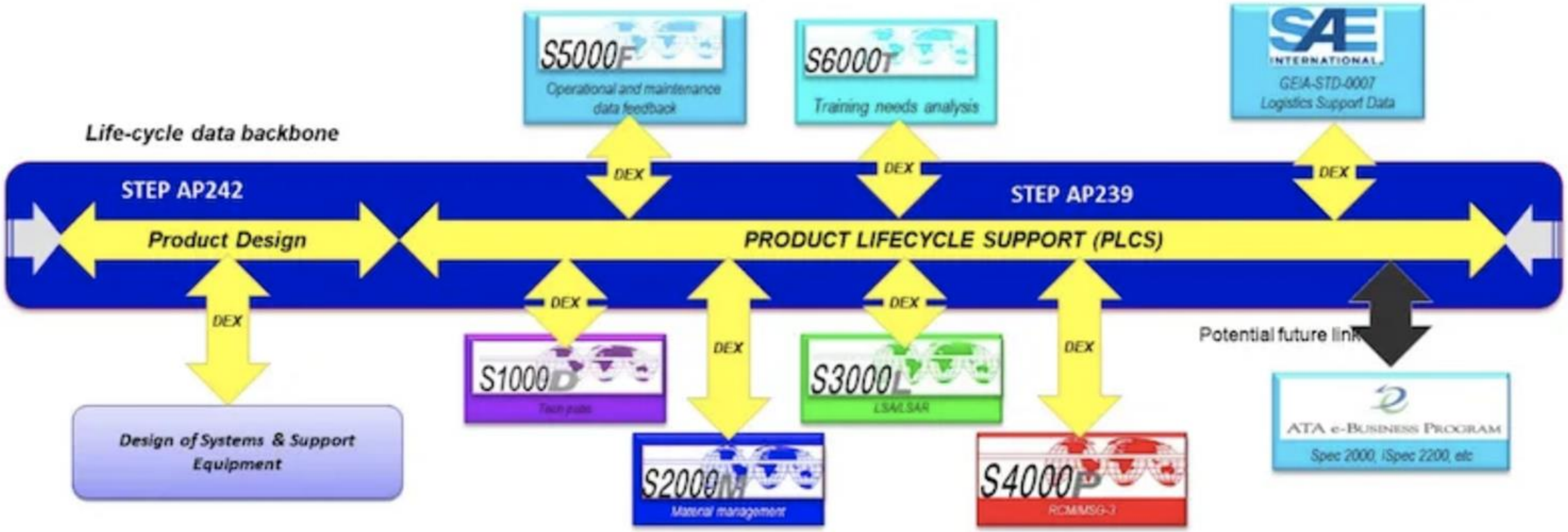
NIST: Research Results and Recommendations for Universally Unique Identifiers in Product Data Standards



AP239 Tutorial at [GPDIS 2022]

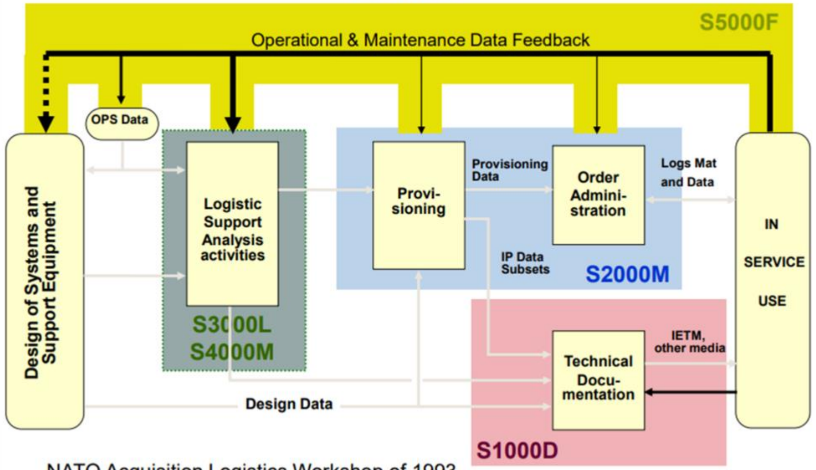


AP239 ed3 (PLCS) enabling interoperability between development and support

The S-Series Integrated Product Support (IPS) specifications is a suite of specifications for product support that will provide the seamless passage of technical data.
The S-Series suite is comprised of the following specifications and can be downloaded for free at the following links:

SX000i: International specification for Integrated Product Support (IPS)
S1000D: International specification for technical publications using a common source database
S2000M: International specification for material management
S3000L: International procedure specification for Logistics Support Analysis (LSA)
S4000P: International specification for developing and continuously improving preventive maintenance
S5000F: International specification for in-service data feedback
S6000T: International procedure specification for training analysis and design

ILS Overall Business Process and the S-Series

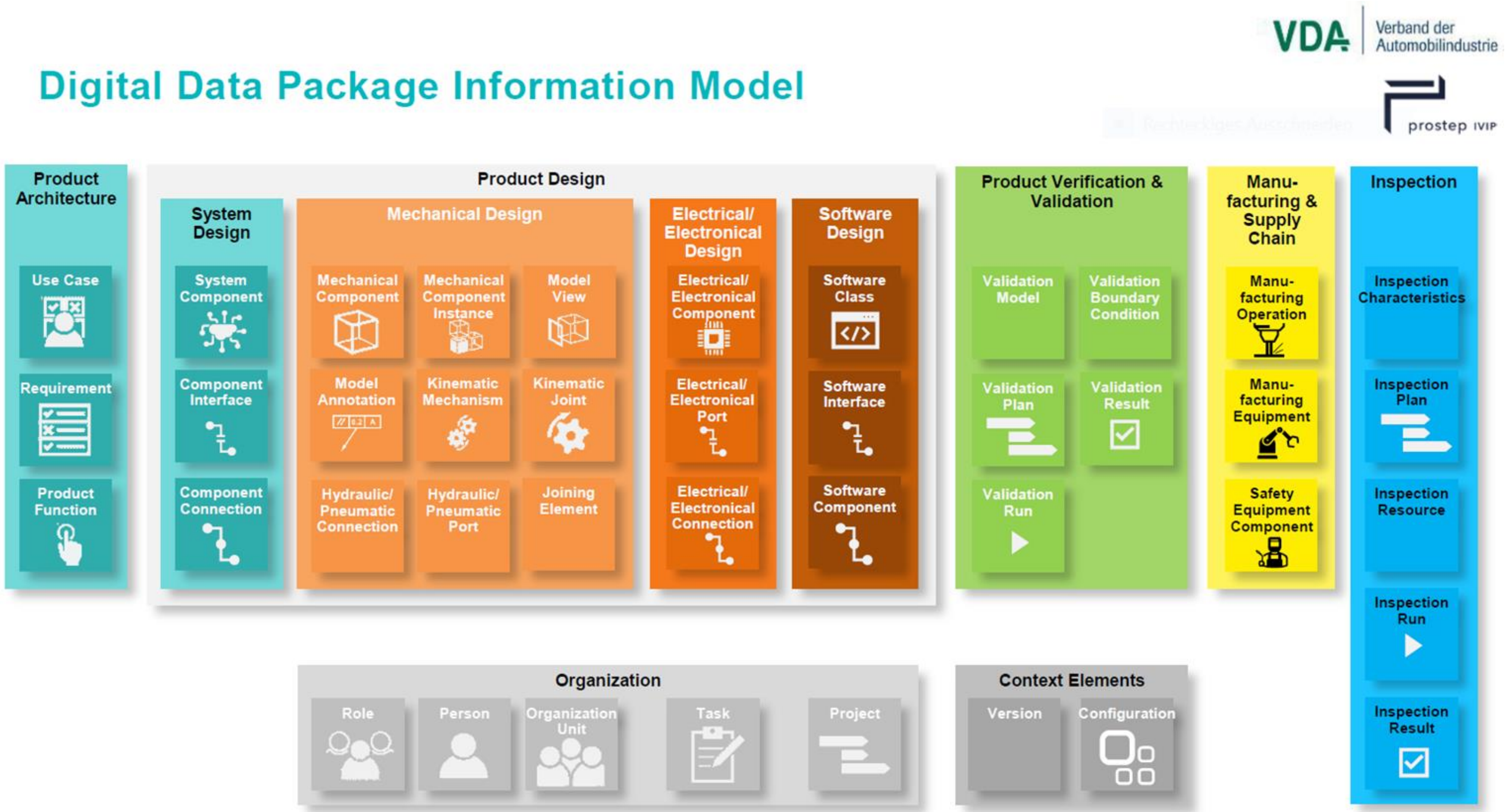


NATO Acquisition Logistics Workshop of 1993

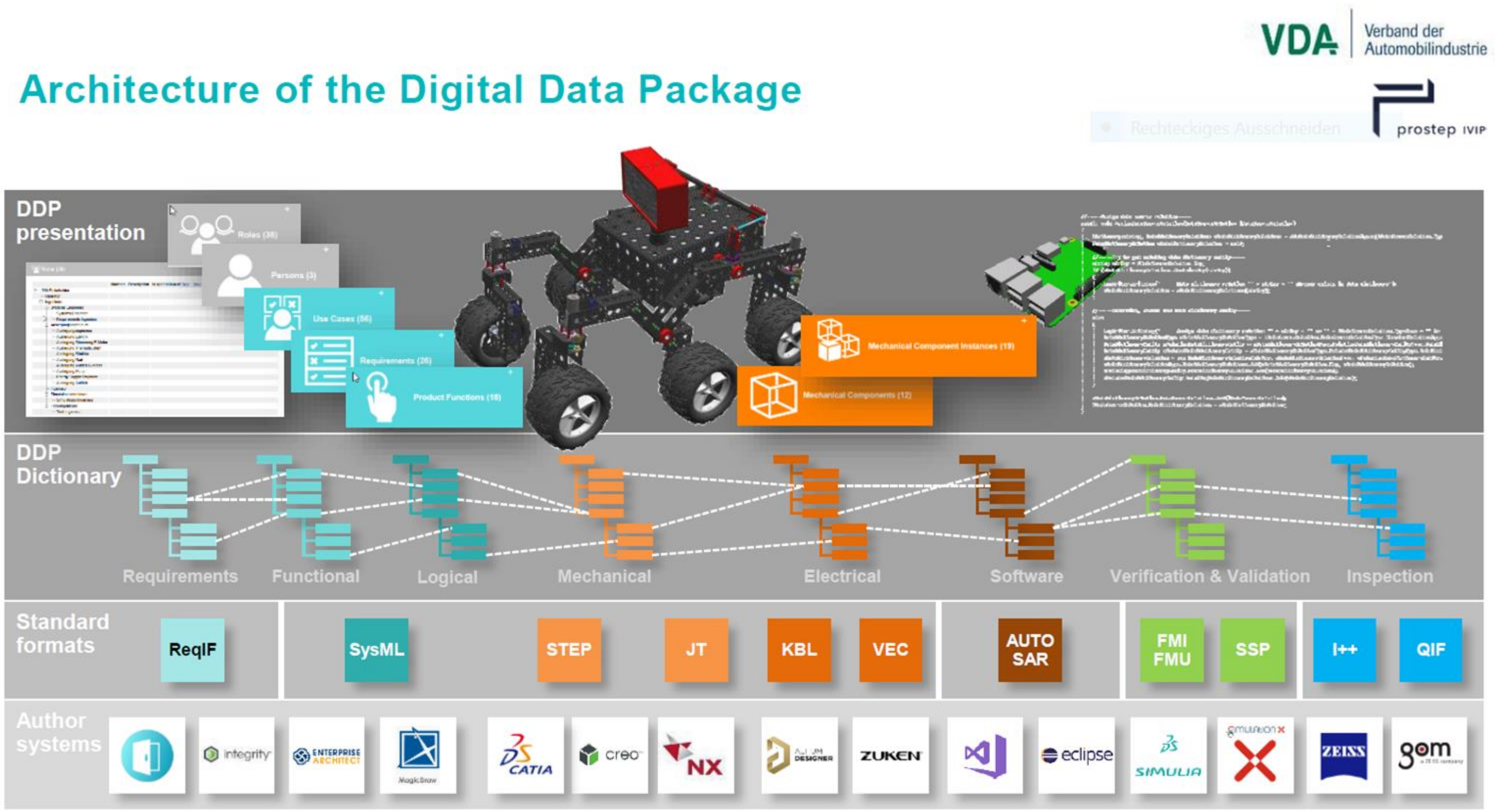
Model Based Systems Engineering (MBSE) - Standards

- **SysML V2**
- **ReqIF**
- **STEP AP242**
- **STEP AP243 MoSSEC**
- **AP233 very old, but how to cover whole SE content?**
- **Modelica FMI, SSP, DCP, eFMI etc.**

Digital Data Package (DDP)

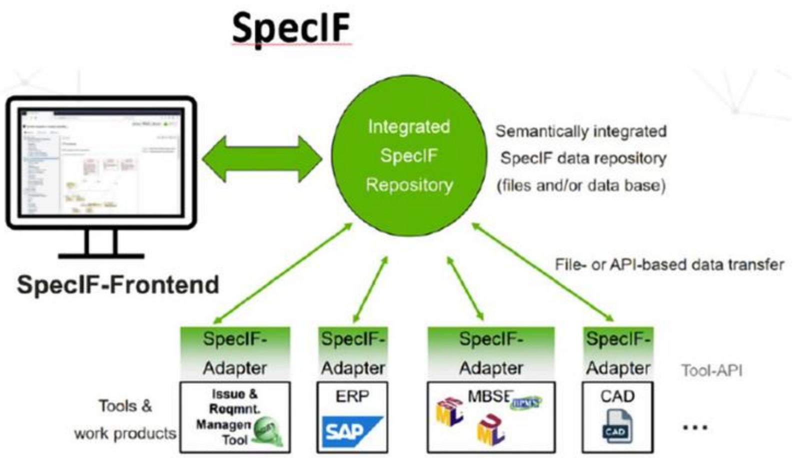


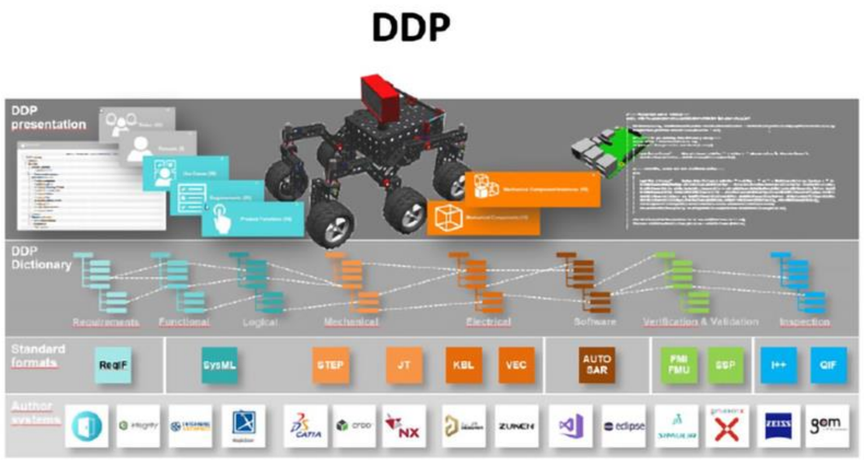
Digital Data Package (DDP)

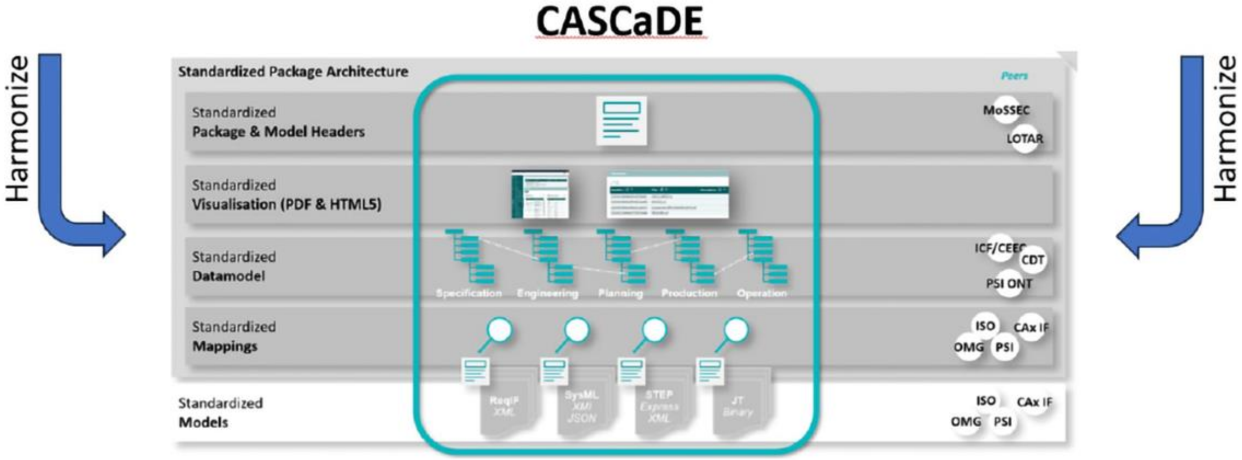


OMG RFP - CASCaDE

Global Product Data Interoperability Summit | **2024**







Finally, ongoing Challenges

Standards

Multiplicity of overlapping formats

Tool Vendors

Proprietary Formats / Solutions / Variety of standards

Platforms / Cloud

Gaia-X / Catena-X / Aerospace-X

Collaboration

Federated Systems / Data Linking

Traceability - agreement on Source of Truth metadata standards (MoSSEC, etc.)

AI

Machine Learning / Large Language Model / Ontologies / Knowledge Graphs

Q&A

Many thanks for your attention