PLM Interoperability and the Untapped Value of 40 years in Standardization

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Digital & Systems Engineering

PLM Road Map™ & PDT North America 2025

PLM's Integral Role in Digital Transformation: From Strategy to Execution
Elevating PLM to an Enterprise Business Solution,
the PLM Professional´s Road Map to Success

May 7 & 8

AGENDA


The Early Days

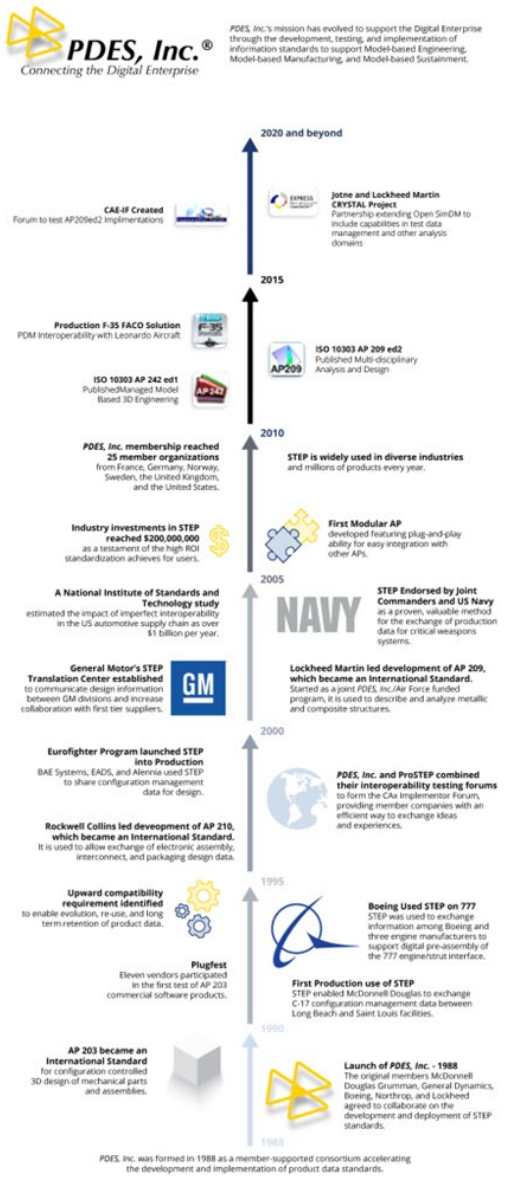

Today’s MBE


The Future


Summary

The Early Days

- "In the beginning… there was product data exchange" NIST 939 July 1999
- Going all the way back to 1970 with ANSI/X3/SPARC, sharing engineering design beyond the drawing has been an issue
- IGES demonstrated the value of file-based data exchange, many other formats followed
- ISO/TC 184/SC 4 – Industrial data formed in 1984
- Product Data Exchange Specification (PDES) was chartered in 1988



https://pdesinc.org/timeline/
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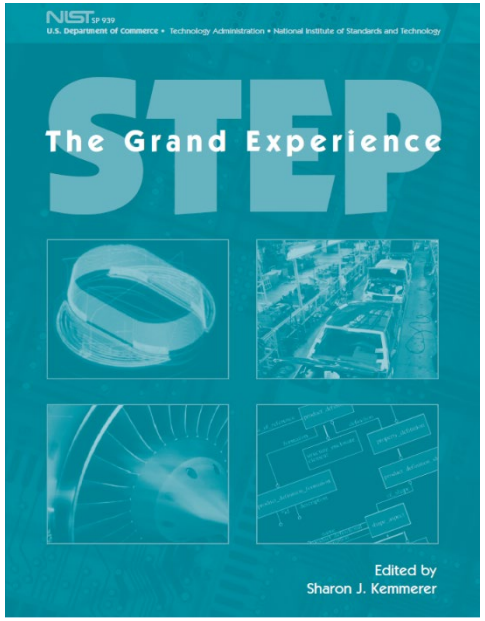

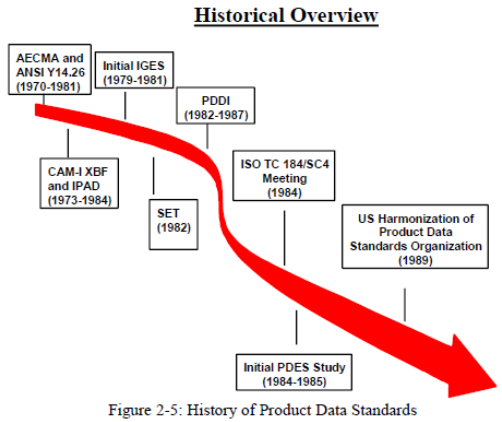

Figure 2-5: History of Product Data Standards

NIST Special Publication 939, July 1999

40 years of standardization!

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The first SC 4 meeting was held in July 1984 at the National Bureau of Standards (now known as the National Institute of Standards and Technology) in Gaithersburg, Maryland USA.

The first version of the STEP standard was published in ~ 1990

RESOLUTION 1: (Gaithersburg - July 1984)

SC 4 recognizes the need for a new standard for the external representation of product model data. This standard will be based upon existing data exchange initiatives including the US IGES and PDDI, the French SET, the German VDA/BDMA-FS, and the UK NEDO.

RESOLUTION 2: (Gaithersburg - July 1984)

The SC adopts the following goal and objectives.

Goal: The creation of a standard which enables the capture of information comprising a computerized product model in a neutral form without loss of completeness and integrity, throughout the life cycle of the product.

Design Objectives: The standard must feature:

- Flexibility to permit expansion without invalidating existing portions of the standard.
- Efficiency for processing, communication and storage.
- Rigorous and formal documentation.
- The minimum possible set of data elements.
- Separation of data content from physical format.
- A logical classification of data elements.
- Compatibility with other existing relevant standards.

Source: https://www.iso.org/committee/54158.html?view=documents

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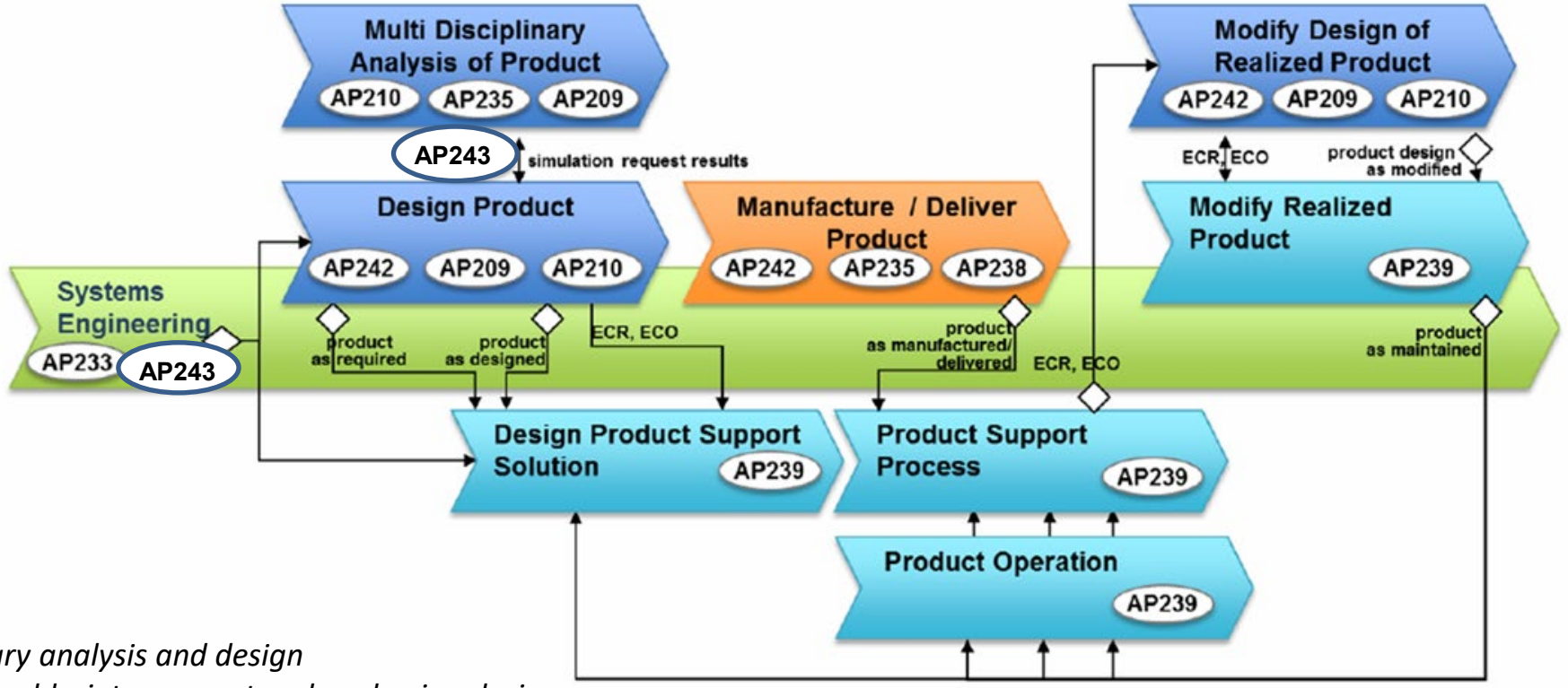
ISO 10303 - Product data representation and exchange



AP209 *Multidisciplinary analysis and design*
AP210 *Electronic assembly, interconnect and packaging design*
AP233 *Systems engineering*
AP235 *Engineering properties for product design and verification*
AP238 *Model based integrated Manufacturing*
AP239 *Product life cycle support*
AP242* *Managed model-based 3D engineering, replaces AP203 & AP214*
AP243 *MoSSEC: modelling and simulation information in a collaborative systems engineering context*

Source: https://www.iso.org/committee/54158.html?view=documents

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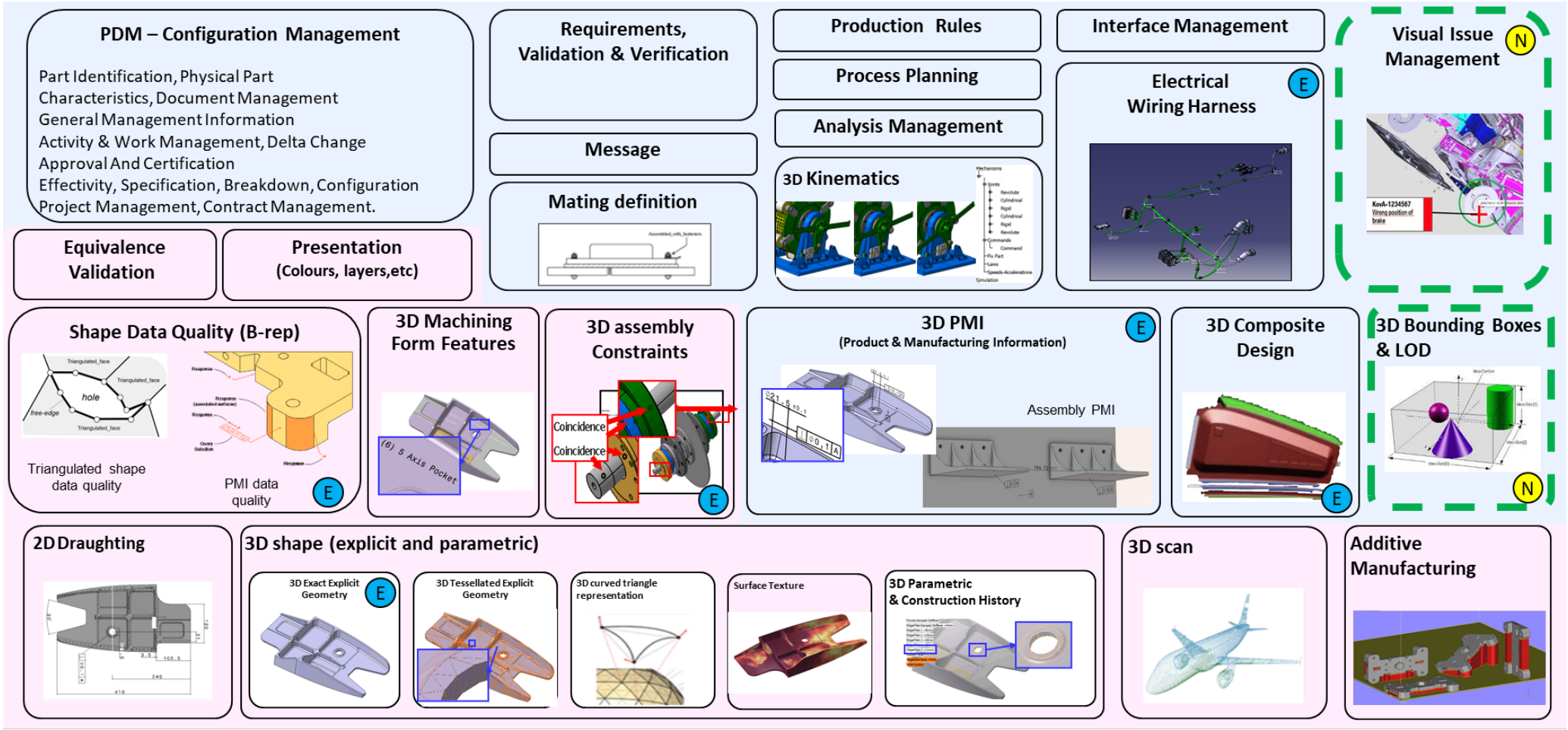
ISO 10303 – 242 ed 4 Managed model-based 3D engineering



Source: https://www.iso.org/committee/54158.html?view=documents

Meeting industry needs

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AP201
AP202
AP203
AP204
AP214

AP242 ed1
2011 - 2014

Consolidation
Multiple industry sector "flavors" consolidated into one common 3D MBE solution

AP242 ed2
2014 - 2020

Major Update
Modular Architecture
Composites
PMI
GD&T
Electrical
PDM
SysML Core Model

AP242 ed3
2020 – 2022

Enhancement
Electrical
Topology
Geometry

AP242 ed4
2022 – 2025

Enhancement
PMI
Composites
Electrical
Assembly
Kinematics

AP242 ed5
2025 - 2027

Enhancement
Fasteners
Composites
PMI
LOTAR
Ontology
Services

Standards operating at the pace of industry
Full Model Based 3D Engineering updates in two-year increments

Source: https://www.iso.org/committee/54158.html?view=documents

JTC 1 Technology
Trend Report
2019

Digital Twin

https://jtc1info.org/public-information/

Executive Summary

The Digital Twin, which combines a variety of modern technologies such as the Internet of Things (IoT), cyber-physical systems (CPS), 3D modeling, simulation, and artificial intelligence (AI), is at the heart of the fourth industrial revolution.

If the Internet of Thing is a disruptive technology that is applied to all industries and services and brings radical changes in human life, the Digital Twin will integrate and interwork the real world and the virtual world based on the Internet of Things.

For this reason, the Digital Twin can be recognized as a dimension bridging technology in which a link is established between the real world and the virtual world.

This document explores the current status of the Digital Twin including technologies including modeling, data process, and fusion, iterative technologies such as simulation and data management.

In addition, industry and market status are explained focused on manufacturing, renewable energy, smart cities, farming, buildings and healthcare accompanied with their standardization activities and possible areas of standardization to JTC 1.

As a conclusion, this document recommends JTC 1 the way of dealing with this topic in terms of JTC 1's perspective of standardization.

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ISO 23247:2021

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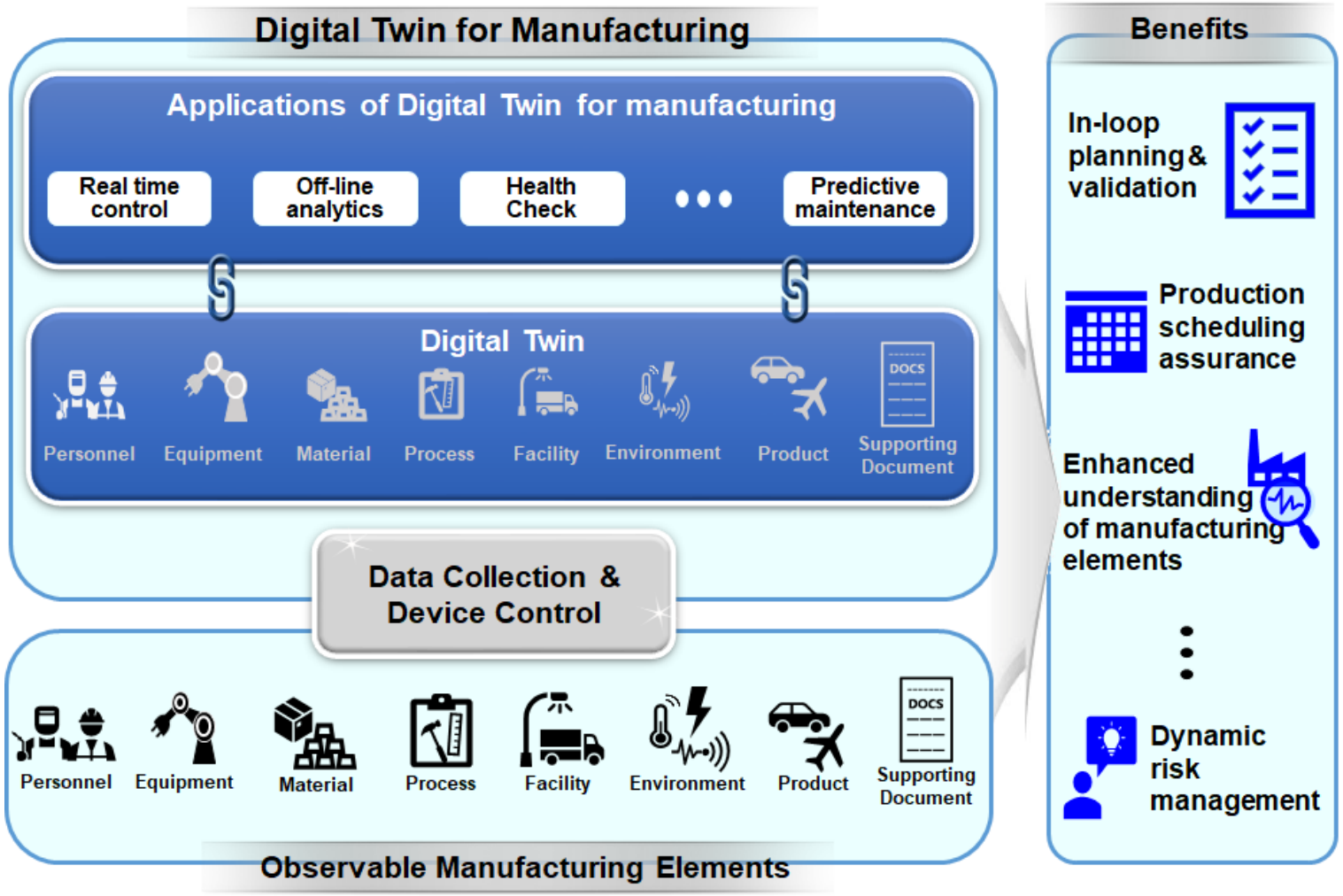
Digital Twin framework for manufacturing



"Twin"

"Framework"

"Manufacturing"

Source: https://www.iso.org/committee/54158.html?view=documents

ISO Smart Manufacturing

”Manufacturing that improves its performance aspects with integrated and intelligent use of processes and resources in cyber, physical and human spheres to create and deliver products and services, which also collaborates with other domains within an enterprise’s value chain”

Source: Definition (ISO SMCC resolution 114/2017)

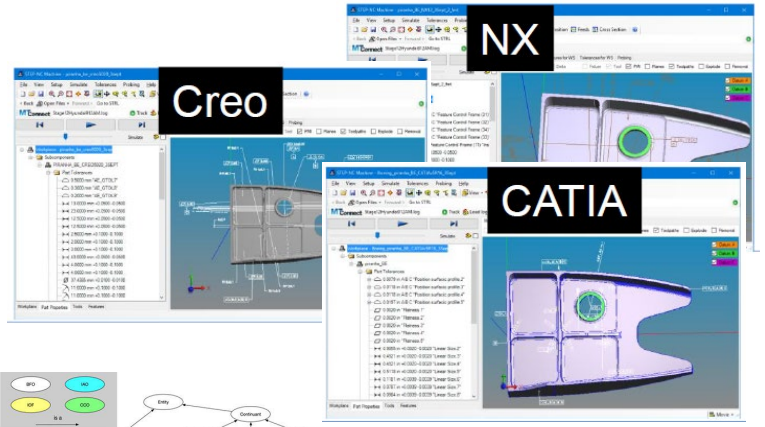
Committees in Coordination

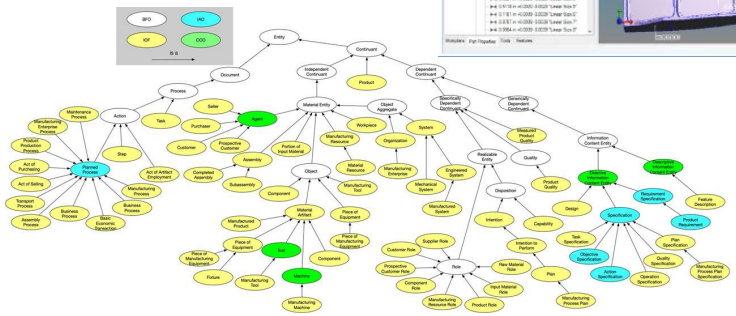
ISO/IEC JTC 1	Information technology
ISO/IEC JTC 1/SC 7	Software and systems engineering
ISO/IEC JTC 1/SC 17	Cards and personal identification
ISO/IEC JTC 1/SC 27	IT Security techniques
ISO/IEC JTC 1/SC 32	Data management and interchange
ISO/IEC JTC 1/SC 37	Biometrics
ISO/IEC JTC 1/SC 38	Cloud Computing and Distributed Platforms
ISO/IEC JTC 1/SC 40	IT Service Management and IT Governance
ISO/TC 10	Technical product documentation
ISO/TC 10/ SC 10	Process plant documentation
ISO/TC 39	Machine tools
ISO/TC 39/ SC 10	Machine tools - Safety
ISO/TC 184	Automation systems and integration
ISO/TC 184/ SC 1	Physical device control
ISO/TC 184/ SC 4	Industrial data
ISO/TC 184/ SC 5	Interoperability, integration, and architectures for enterprise systems and automation applications
ISO/TC 199	Safety of machinery
ISO/TC 211	Geographic information/Geomatics
ISO/TC 261	Additive manufacturing
ISO/TC 292	Security and resilience
ISO/TC 299	Robotics

https://www.iso.org/publication/PUB100459.html

Back to the Future: Euclid vs Aristotle

- Euclidian models are deterministic; precise geometric representations
- Ontologies are stochastic models of classification; great for classifications
- Product models need ontologies! But how to connect?
- Top Level Ontologies like ISO 21838 – 2 and ISO/CD 23726 – 3 offer a path
- No one must drink Hemlock!






ISO 23726-3:2024(en)
ISO/TC 184/SC 04/WG 26
Date: 2024-03-08

Automation systems and integration — Ontology based interoperability — Part 3: Industrial data ontology

CD stage

Warning for WDs and CDs

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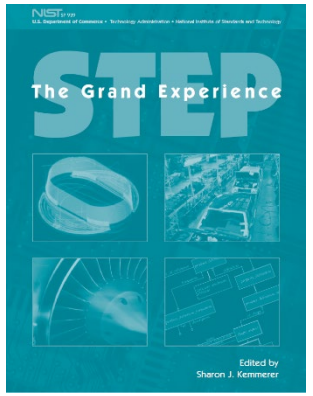
Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

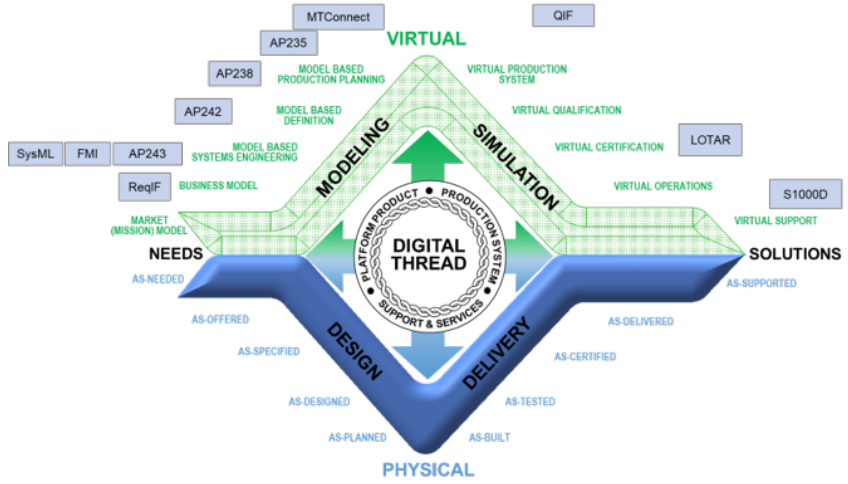
https://www.iso.org/standard/87560.html

Summary

- The past 40 + years have created a rich, highly structured data set for the future; many repositories of legacy data waiting to be tapped
- The business needs and the use cases for value have changed; digital transformations have identified data reuse and seamless flow as a priority
- Technology solutions are evolving quickly and exposing new value propositions for data use; Ontologies, reasoning engines and AI are rapidly evolving
- Standardization bodies are quickly developing solutions and developing winning methods to move quickly



Data standards that enable the digital thread



https://www.boeingsuppliers.com/become/modelbasedengineering/mbe-data-and-process-standards