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STEP in the USA
an update from PDES, Inc

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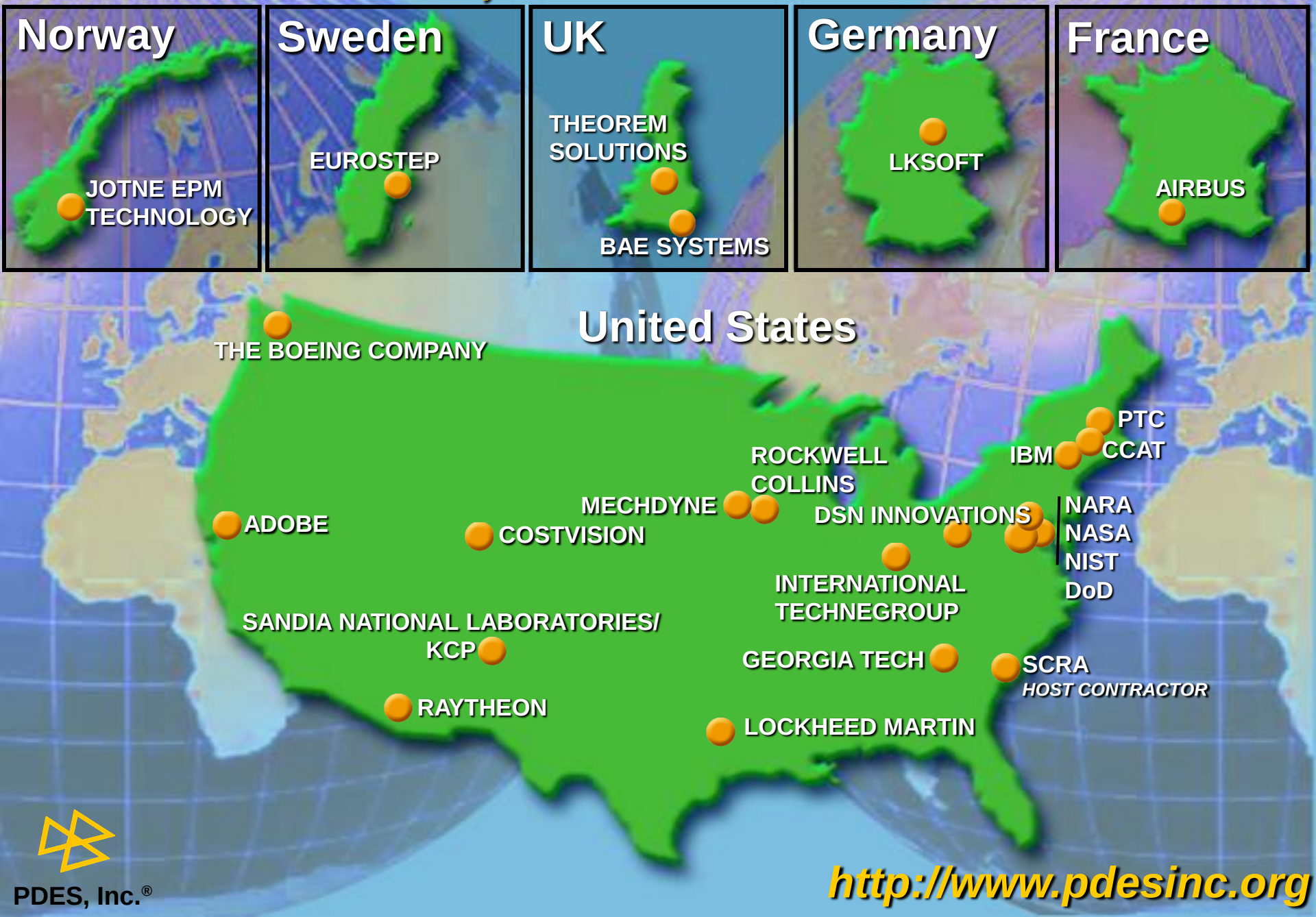
PDES Board Champion for Alliances and Partnerships

PDES, Inc. Members



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http://www.pdesinc.org

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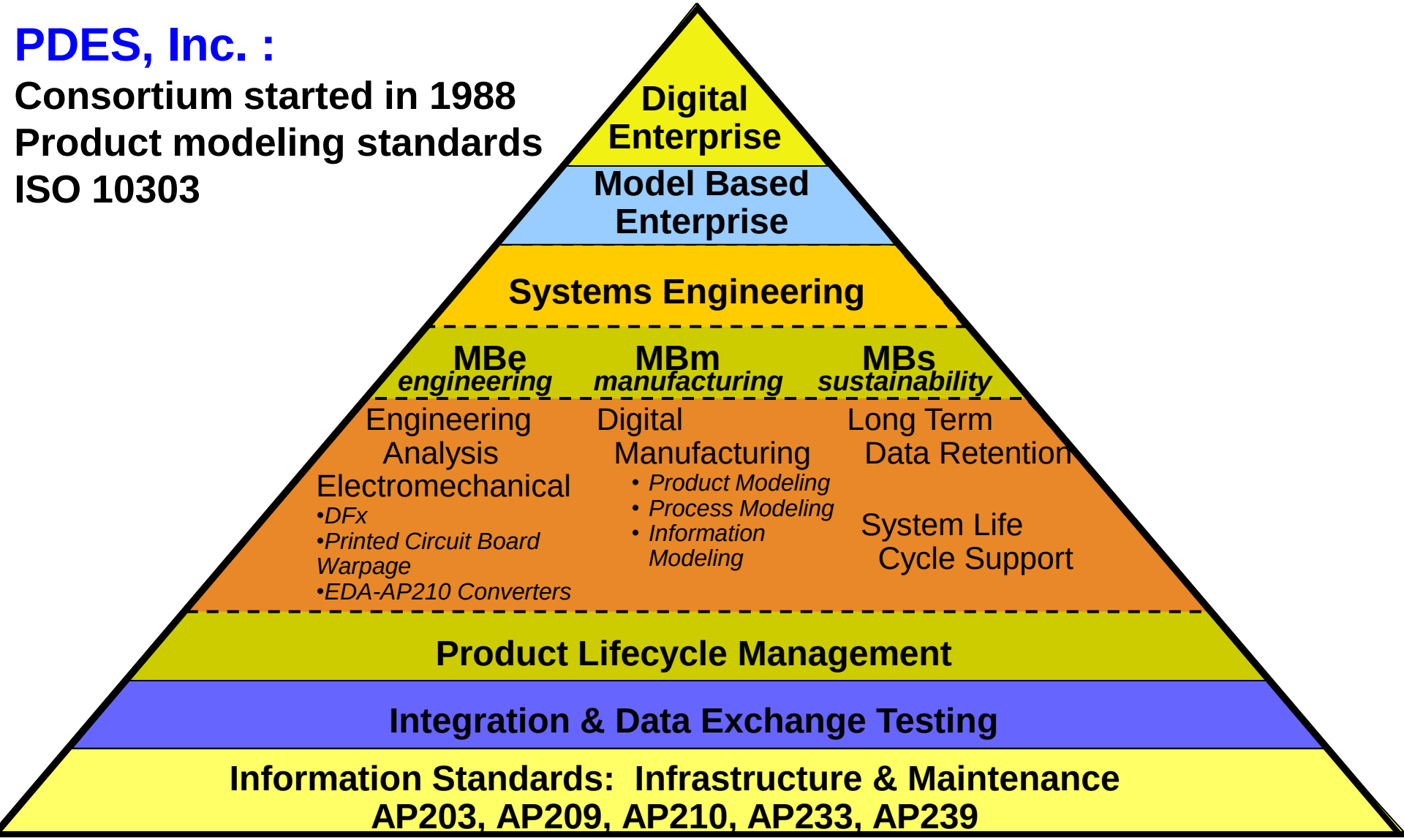
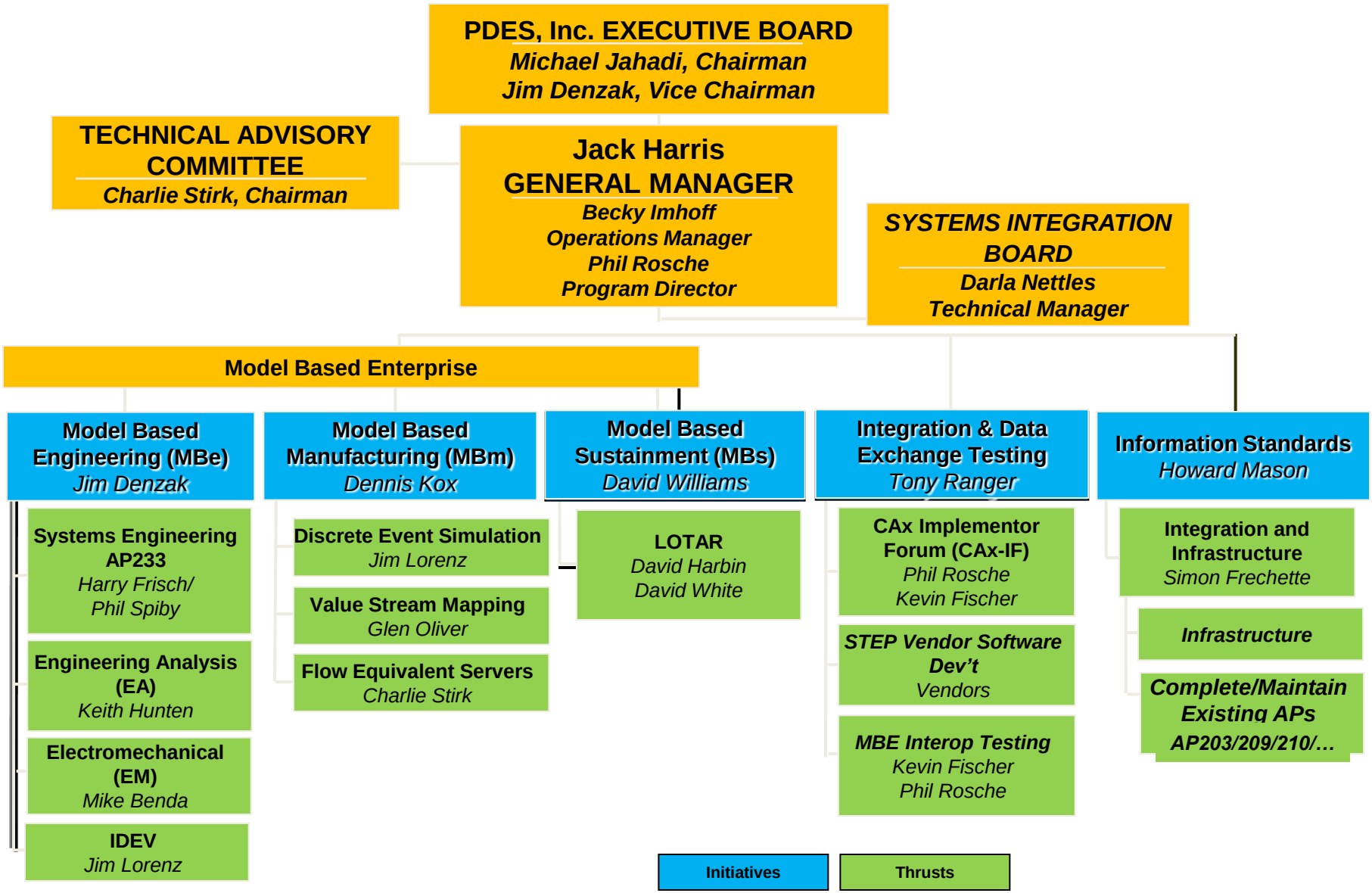
Consortium started in 1988
Product modeling standards
ISO 10303

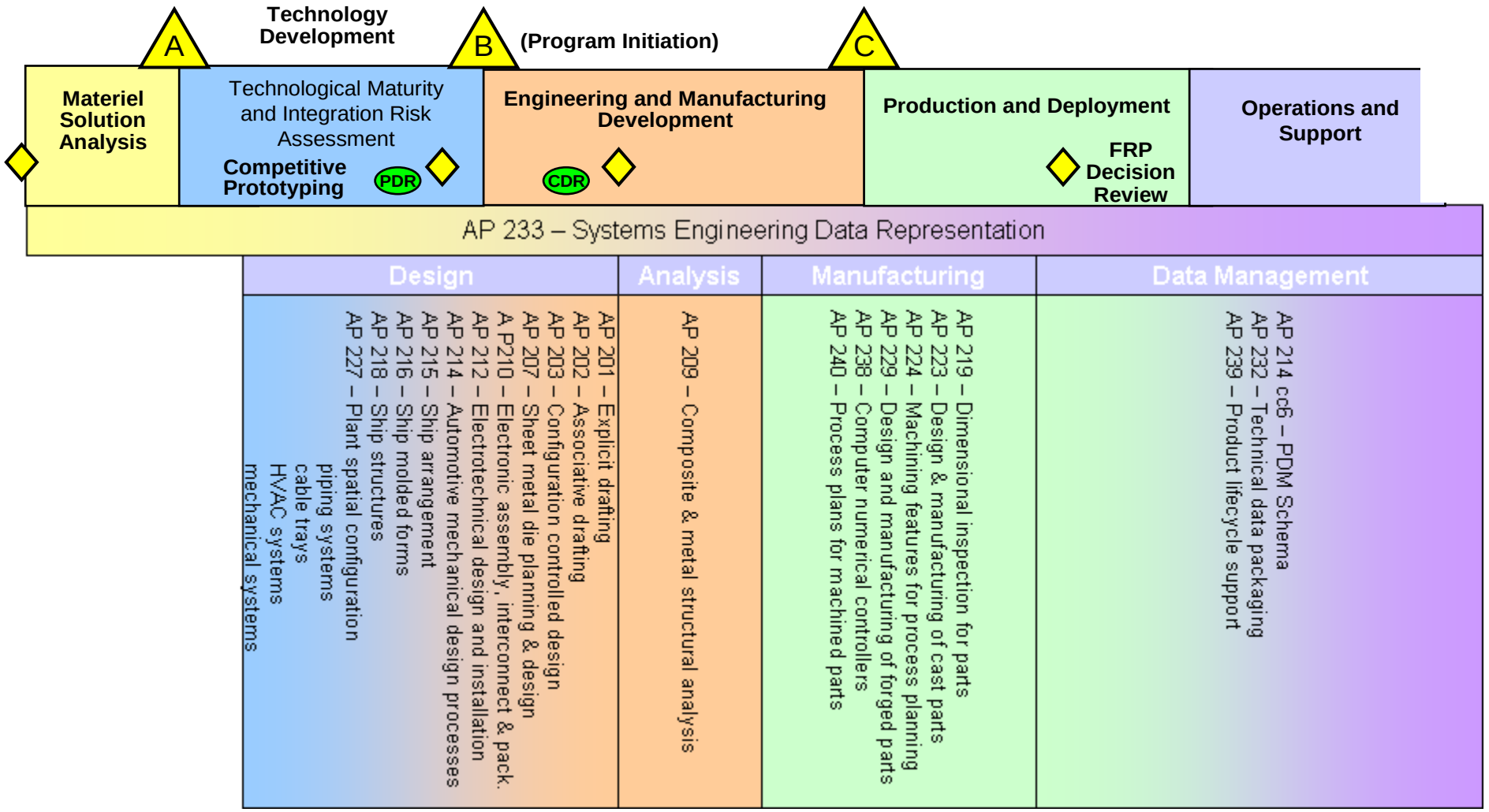


PDES, Inc. Digital Enterprise Phase

Technical Organization



STEP for DoD Acquisition Cycle



US Mandates for ISO 10303 (STEP)

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- **NASA-STD-2817, Chief Information Officer, 1999**
  - **requirement for Computer-Aided Engineering, Design and Manufacturing systems used by NASA to have interchange tools that support ISO 10303**

- **Assistant Secretary of the Navy RDA Memo, Oct. 23, 2004**
  - **"procure all product/technical data in attachment (1) digital formats and ensure product model data meets ISO/STEP requirements specified in attachment (1)." STEP for 2D & 3D CAD**

- **Office of the Secretary of Defense ATL Memo, June 21, 2005**
  - **"implement a similar approach that adopts ISO 10303 to enhance interoperability" as described in Navy memo above, also UID**

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Recent US Guidance on STEP

- **NATO STANAG 4661, ratified by US**
  - **"Ratifying nations agree to apply ISO 10303-239 for product data management in cooperative NATO acquisition programs."**

- **Acquisition and Sustainment Life Cycle Management, Air Force Instruction (AFI 63-101), April 17, 2009**
  - **"The PM shall require the use of International Standards Organization (ISO) 10303, Standard for Exchange of Product (STEP) Model Data, AP239, Product Life Cycle Support, for engineering data "**
  - **"Legacy system modifications shall implement ISO 10303 for new engineering data to the maximum extent feasible. Conversion to ISO 10303 for the entire legacy system is encouraged when supported by a positive business case analysis (BCA)."**
  - **"When acquiring Computer Aided Design (CAD) data, the PM shall require delivery in both native format and neutral format."**

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Modular STEP AP's by PDES

- Application Protocol (AP) Modularization Benefits
  - Standards as a database
    - Faster revision process (months rather than years)
  - Interoperability of implementations through reuse
    - Requirements, structure, etc.

- Modular AP Domains
  - AP203 Mechanical CAD (parts & assemblies)
  - AP209 Structural Analysis (FEA and CFD)
  - AP210 EDA/MCAD (electrical and mechanical assemblies)
  - AP233 Systems Engineering
  - AP239 Product Life Cycle Support (PLCS)

STEP Mechanical CAD

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- STEP is the “most common format for 3D model interchange”
  - Collaboration & Interoperability Market Report
  - Surveys in 2007 & 2008

- MIL-STD-31000 Technical Data Package
  - Guidance to acquire technical data
  - Calls out STEP for 3D Models
  - Critical manufacturing process data
    - Required if only one known method to manufacture

- ASME Y14 series for Dimensioning and Tolerancing
  - Considering data set standards from US Army TACOM and Lockheed Martin

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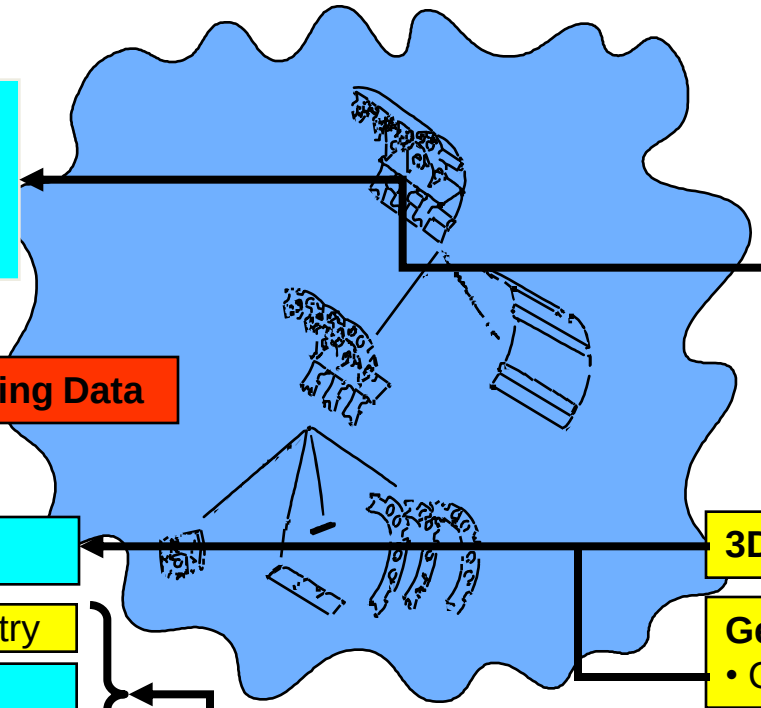
AP203
Configuration Controlled 3D Design of Mechanical Parts and Assemblies

Blue = 203 (First Edition)
Yellow = 203 ed2 TS (Completed)
Red = 203 ed2 (New)



Product Identification
- Definition
- Version
- Identification

Cataloging Data

Configuration Effectivity
- Effectivity
- Certification

Work Management
- Work Order
- Authorization

Product Structure
- Assembly structure

Geometric Shapes
- Constructive solid geometry
- Advanced BREP Solids
- Faceted BREP Solids
- Manifold Surfaces with Topology
- Wireframe with Topology
- Geometrically Bounded Surfaces and Wireframe

3D Associative Text

Geometric Presentation
- Colours, Layers & Groups

Geometric Validation Properties

Materials Data

Solid Model Construction History

Geometric Dimensioning and Tolerancing and callouts

Composite Structure and Shape (AP209)

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Convergence of AP203 (Aero) and AP214 (Auto)

- Create single superset standard for MCAD
- Already harmonized for geometry (translators handle both)
- 214 adds the following capabilities
  - Manufacturing process planning
    - Relate plans, operations, tools, raw/in-process/finished, projects, other activities, etc.
  - Kinematics
  - OMG PLM Services (web services API) for Engineering Change
- Modularization for interoperability across domains
- Future versions could include content from other domains
  - AP232 Technical Data Packaging (TDP)
  - AP212 Electrical Harnesses
  - AP224 & 240 Machining Features & Process Planning
  - AP210 for Mechatronics

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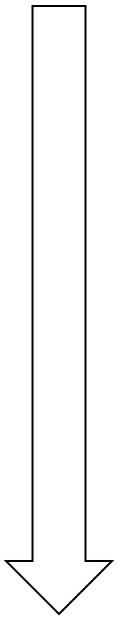
AP210 Electromechanical Hierarchy

Supports explicit traceability of connectivity through multiple levels of product hierarchy whether the product is modeled in ECAD or in MCAD.



- Bare Die
- Electrical & Electromechanical Components
- Printed Circuit Boards & Assemblies
- Modules
- Cables
- Black Boxes
- Electrical Equipment Racks

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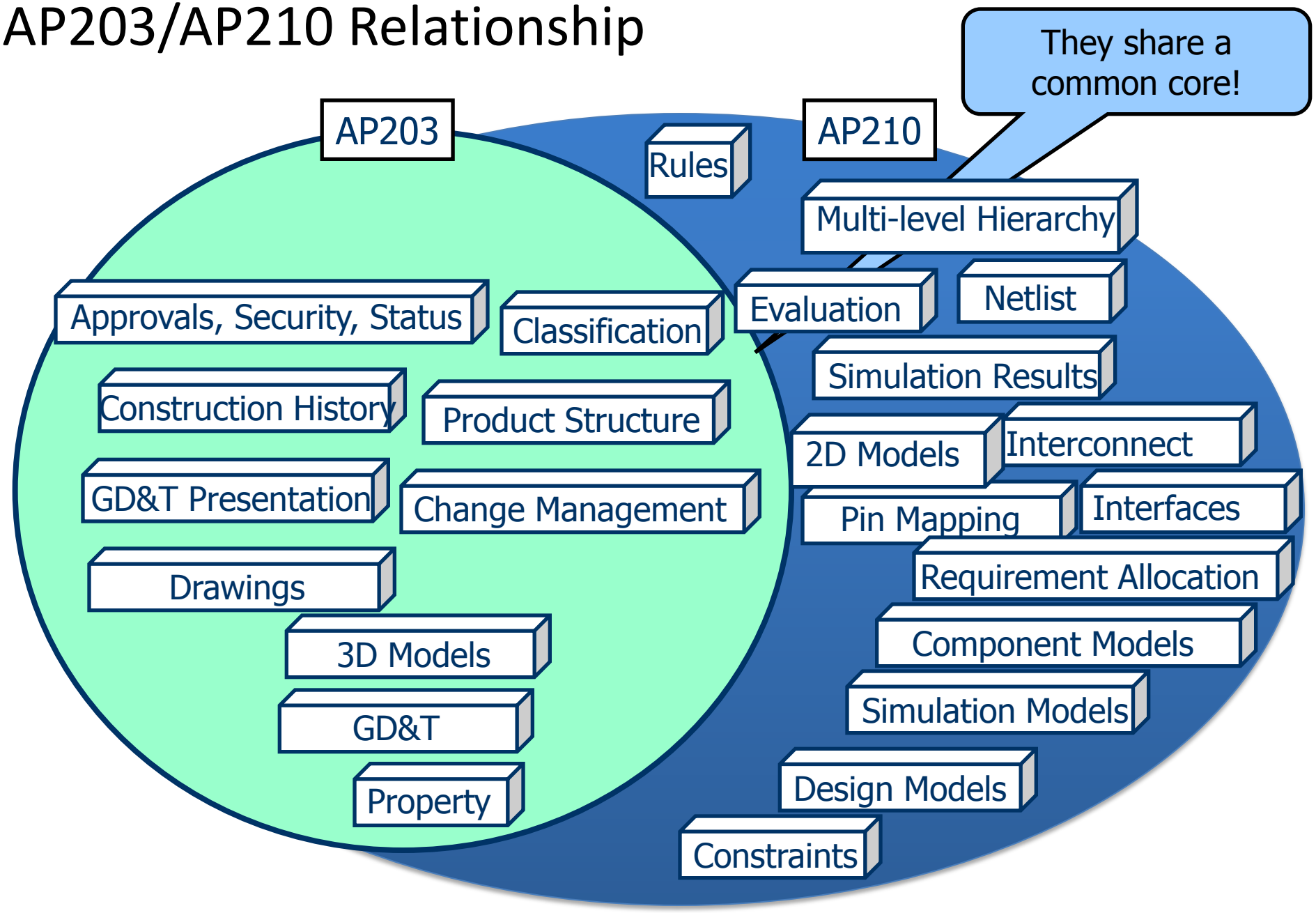
AP210 Implementations

- In Production Use
  - Design rule checking
  - Durability analysis
- New Developments
  - Integrated 3D component models and 2D footprint libraries
  - Offspring (IPC 2581) mappings and translation
  - EDA -> Finite Element Analysis of PWA/PWB
  - Warpage simulation
  - Immersive 3D Visualization

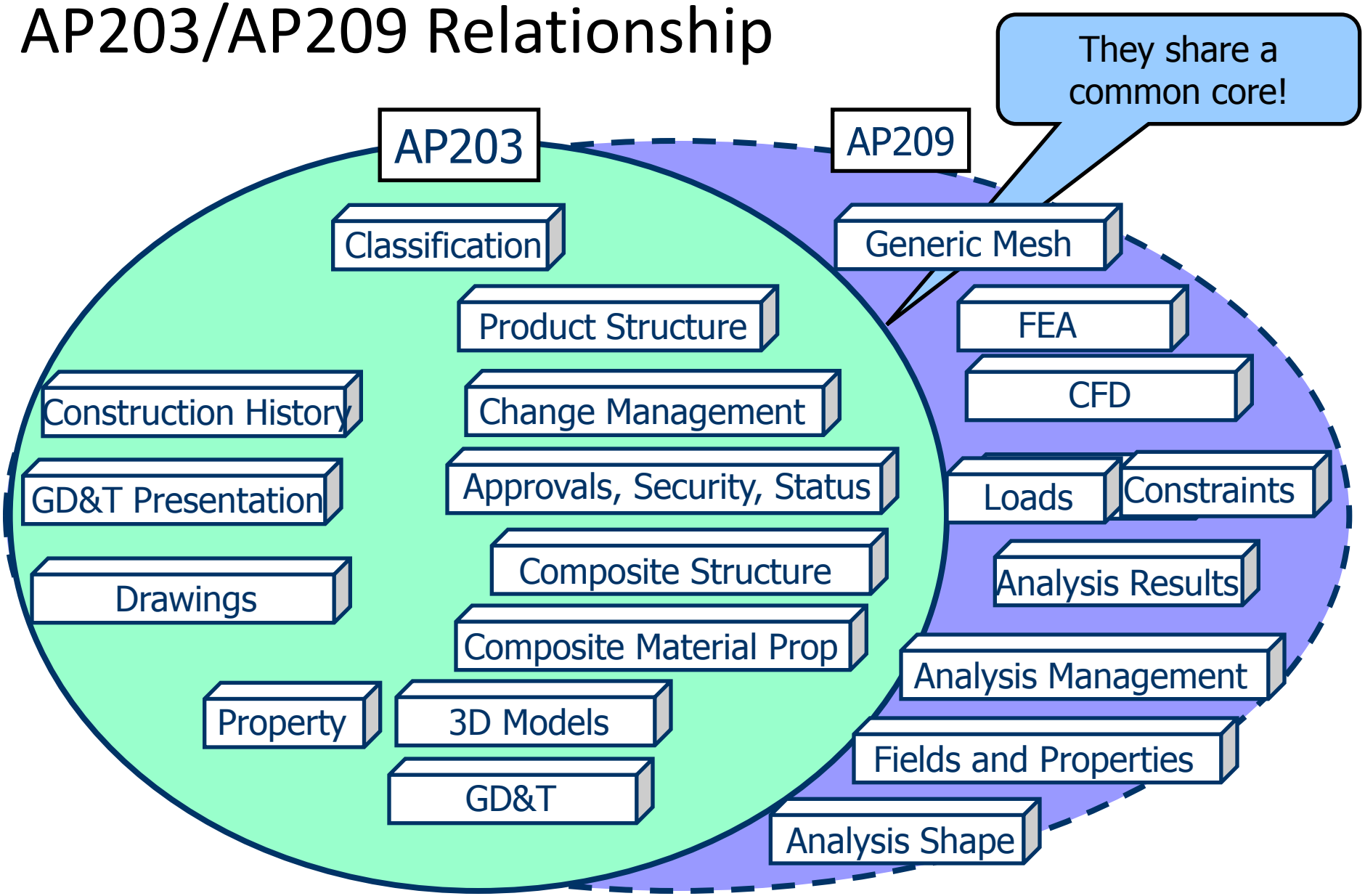
AP203/AP210 Relationship



AP209 Structural Analysis

- Mechanical Analysis
  - Computational Fluid Dynamics (CFD)
  - Finite Element Analysis (FEA)
  - Analysis Results and Management
- Current Projects
  - Binary File Format
  - Archival
  - Simulation Data Management

AP203/AP209 Relationship



CAx-Implementer Forum

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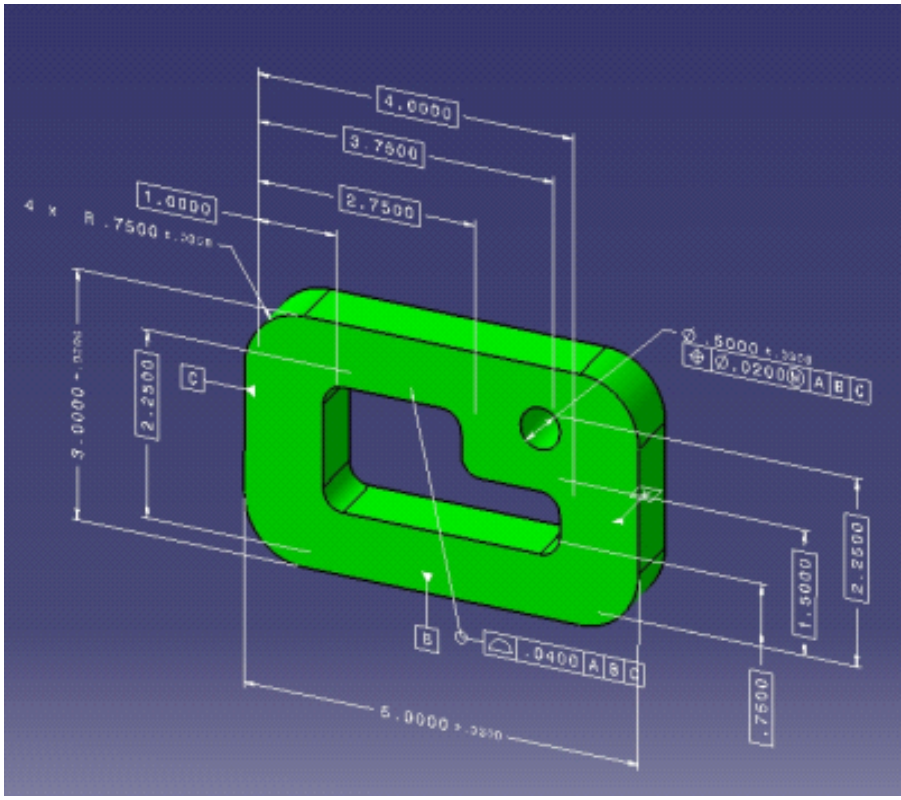
- Joint testing effort in CAx-IF
  - PDES Inc. & ProSTEP iViP
  - Participants: Adobe, AutoDesk, CostVision, Dassault Systemes, DataKit, EuroStep, ITI TranscenData, Kubotek, PTC, Siemens PLM Software, T-Systems, Theorem Solutions
- Bi-annual rounds of testing of CAD data exchange
  - Cooperate on implementing STEP
  - Accelerate translator development
  - Promote interoperability
  - Scope is AP203 and AP214
- www.cax-if.org



Test Model for PMI Semantic Presentation and Representation

CAx-IF Test Cases

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Recent Functionalities

- Density and Material Name
- Supplemental Geometry
- Wireframe Geometry
- External References
- Colors, Layers & Groups
- Cloud of Points
- AP Interoperability

Current Test Cases for Round 25J

- Geometric Validation Properties
- PMI Polyline Presentation
- PMI Representation and Presentation
- User Defined Attributes
- Problematic production models

LOTAR International

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Long-Term Archiving and Retrieval (LOTAR)	Parties to MoU
• 3D CAD and PDM data • Information content • Processes required • Standards harmonization • GD&T called-out • Test at CAx-IF	• PDES Inc. • ProSTEP iViP • Aerospace Industries Association (AIA) • ASD-STAN (European Aerospace Standards)

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Enterprise-Class STEP

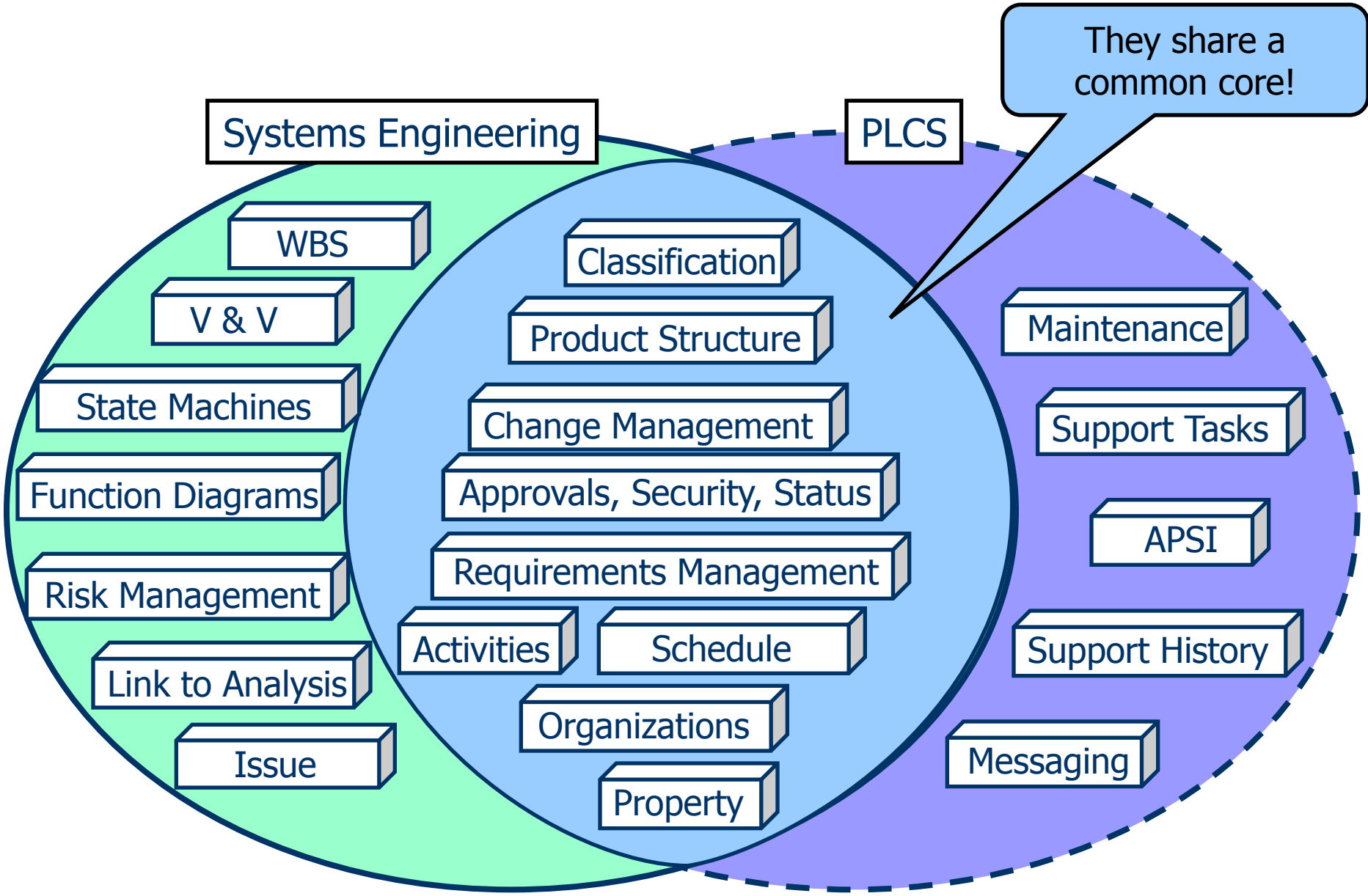
Product Life Cycle Support

- AP239 PLCS
- US Army TACOM
  - Requiring on contracts
- US Army LOGSA
  - Logistics Support Analysis
  - DEX's based on MIL-STD-1388
- US NAVAIR
  - UH-60 pilot
- NAVSEA
  - Ship Common Information Model (SCIM)
  - Logistics Support Information
  - Ship design tool integration

Systems Engineering

- AP233 SE
- OMG SysML Mapping
- OMG Model Driven Architecture
  - Interoperability with UML software development tools
- INCOSE Professional Society
  - Product of the Year 2009 Wording Group Award
  - Model Driven System Design
  - Co-Chair, Phil Spiby, Eurostep

Systems Engineering/PLCS Overlap



Open Applications Group Inc. (OAGi)

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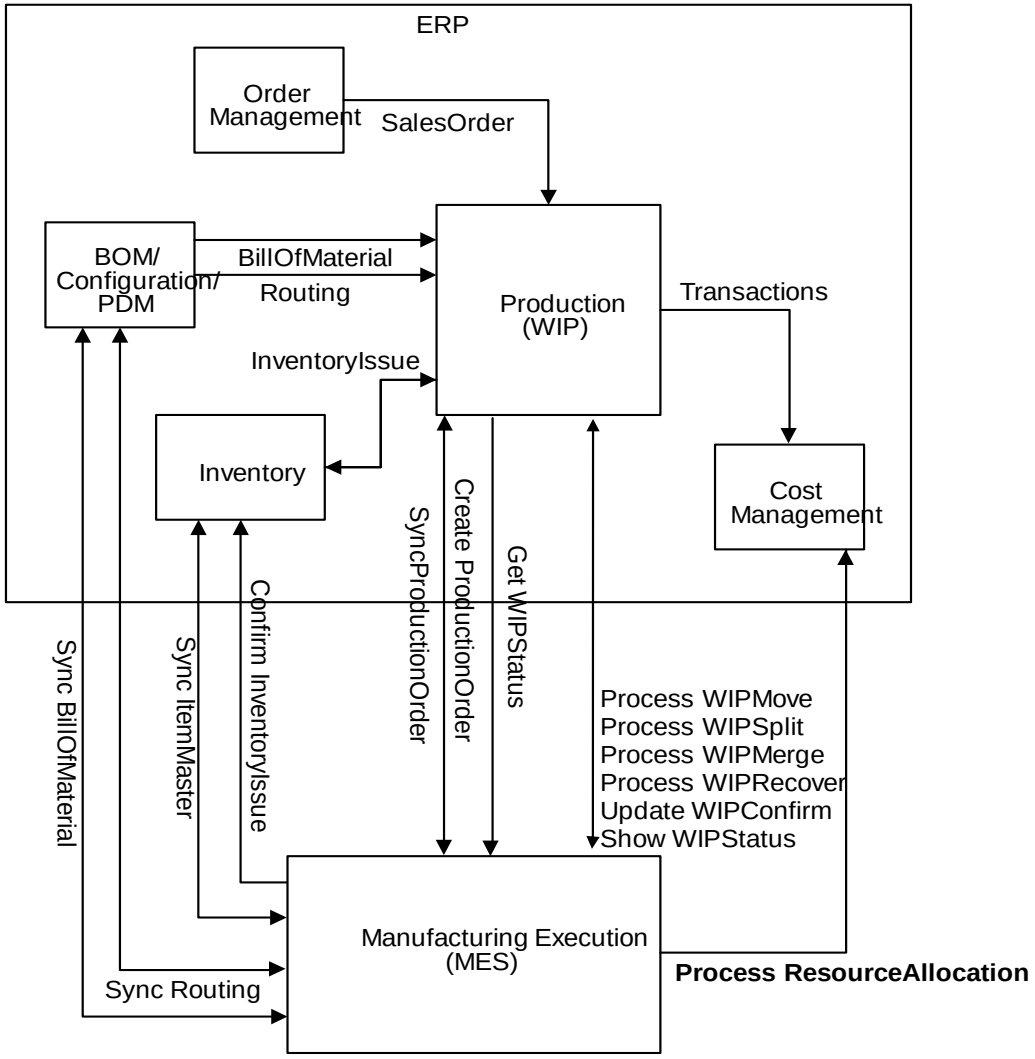
- Data Models
  - BOM
  - Routing
  - WIP
  - RFx
  - ECx
- OAGIS open source
  - Extendable
  - Data model & API
- Supported by major
  - ERP (SAP, Oracle, Infor)
  - MES (Solumina, Rockwell Automation)
- Suitable for integration
  - Within company
  - Across supply chain



Interoperable PLM Web Services

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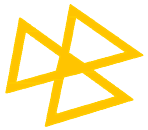
- OMG PLM Services
  - WSDL for Engineering Change
  - Standardized through OMG (Object Management Group)
  - XML Schema based on STEP AP214 ed3
  - Used in Auto supply chain
  - Retained in 203/214 Convergence

- Mapping OMG PLM Services Schema to OAGIS for Part, BOM, EC
  - OAGIS used as API to downstream ERP and MES
  - Proposed future mappings
    - Manufacturing process planning
    - PLCS

- PLCS PLM Services
  - Can emulate OMG PLM Services
  - Create, Read, Update, Delete, Where Used, Session Management



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CAD/CAE Web Services Proposal

- Common API to CAD/CAE tools
- Use portions of CAD models
  - PMI
  - Construction History
  - User attributes, Material Name
  - Assembly structure
  - Geometry
- Benefit from experience with other web services and earlier OMG CAD Services

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Manufacturing Process & Supply Chain Models

- Value Stream Mapping Standards Needed
  - Standard symbols and model elements
  - Enable static analysis (line balancing, work cell)
  - Input to discrete event simulation
- Detailed Discrete Event Simulation
  - NIST Core Manufacturing Simulation Data model (CMSD)
  - Standardization at SISO
    - Neutral format for detailed mfg. models
    - Input to Delmia Quest, Arena
- Flow Equivalent Server Project
  - Hierarchical simulation
  - Hides proprietary information
  - Supply chain integration
  - PLCS for model management

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DoD Model Based Enterprise Projects

- Current Projects
  - Interoperability of CAD and 3D immersive Virtual Reality
  - Cost models driven from CAD and shop-floor
- Request for Proposals
  - Cost in trade space analysis and DFX rules engines
  - Composite manufacturing & lifecycle cost
  - Producibility analysis and integration with real-time shop-floor
  - Reverse engineer to create 3D models & CAD based remanufacturing
  - Detailed design tool integration
  - Supply chain simulation

STEP is

- Most common CAD exchange format
- Interoperable with other engineering domains
- Usable across the life cycle
- Extendable with reference data
- Supporting web services and SOA
- Mandated for government programs
- Harmonizing with other standards
- Basis for supply chain hubs
- Migrating to software modeling environments

Upcoming PDES Off-site Meeting

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- NIST in Washington DC, March 15-19, 2010
  - Coincident with Ontolog Summit and Interoperability week
  - Joint sessions and invite OAGi also
- Workshop on next phase of PDES Technical Development Plan focused on Implementation of MBE
- Gather further input on requirements for DoD Technical Data Package standard (MIL-STD-31000)

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