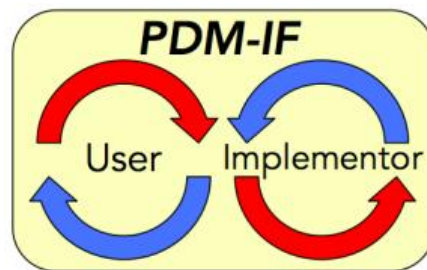


White Paper for the creation of the PDM Implementor Forum



Version 1.2

29/01/2015



White paper for the creation of a PDM Implementor Forum

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Document history

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| V0.1 | 2013-10-10 | Initial version | J. Brangé, J-Y. Delaunay |
| V0.2 | 2013-12-01 | Update of every chapters | F. Darré |
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| V1.1 | 2014-12-14 | Updated from Oct.22, 2014 telco comments | K. Le Tutour, J. Brangé |
| V1.2 | 2015-01-29 | Updated from Oct.22, 2014 telco comments | K. Le Tutour, J. Brangé |

1 Executive summary

The objective of this white paper is to prove that the PDM Implementor Forum is both feasible and required to develop better communication between heterogeneous PDM systems.

The first goal of the PDM-IF is to develop international PDM interoperability recommended practices:

- Answering manufacturing industries needs of a set of consistent standards providing PDM information models and associated recommended practices for PDM interoperability;
- Covering the full product life cycle, from concept phase, to support and dismantlement;
- Common to the different disciplines, systems, structures, etc.;
- Managed consistently through the time by ensuring upward compatible with legacy PDM standards and existing PDM data repositories;
- Based on an open web based infrastructure;
- Providing common guidelines for the PDM domain of the following STEP modular Application Protocols: AP 209, AP 233, AP 242, AP 210, OASIS PLCS and AP 239.

PDM-IF context

This document sums up the context of the start of the PDM-IF activity by explaining the role of an Implementor Forum in the industrial & standardization contexts, its history and a first list of interested parties from Aerospace & Automotive industries, sponsoring associations, large PLM vendors, SME PDM vendors & integrators and collaborative platform companies.

Industries requirements and business drivers

The white paper collects industrial requirements and benefits for an international PDM-IF from Automotive, Aerospace, Defence and other OEM manufacturers, from SMEs, and from PDM vendors & integrators.

Scope and main tasks

The general scope is defined through the PDM-IF's four main tasks, use cases and deliverables. The four main tasks of the PDM-IF are:

1. Description of use cases and prioritization for implementation;
2. Development and maintenance of STEP PDM recommended practices;
3. Interoperability testing and associated test rounds;
4. Publication, outreach, coordination and communication.

The main deliverables of the PDM-IF are: the agreed description of Industry Use Cases for PDM information interoperability; the development and maintenance of PDM Recommended Practices; High level testing plan; General testing instructions; Test suite/test cases; High level testing results (publically available); Detailed testing results (privately available) and Feedback to standard developers.

Use cases

The scope of PDM-IF use cases is: PDM data exchange, PDM data long term archiving, PDM data integration/sharing, and PDM linked data, based on STEP Application Protocols, OASIS PLCS standards and other related implementation standards, such as OMG PLM services, OSLC, etc.

A first proposed list of use cases is given. The first proposed use case is: explicitly Configured "as designed" PDM product structure exchanges as single AP242 BO Model XML file with referencing 3D CAD models (in STEP or other CAD format) with validation properties in XML.

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Methods of prioritization and description of use cases are provided by the PDM-IF Operations Manual document. A standardized, model based approach shall be used for capturing and interrelating use cases, test scenarios, and recommended practices, as one of the technical principles of PDM-IF.

Project organization and management

Type and role of participants are defined: the 2 main groups are the User group – composed of stakeholders – and the Implementor group – composed of editors, integrators and experts. The project plan is based on a yearly schedule and on clear and precise roadmap. Lastly, financial principles of PDM-IF are provided.

2 Introduction

The objective of the PDM Implementor Forum (PDM-IF) is to accelerate the development and general availability of PDM interoperability solutions based on ISO open standards.

These interoperability solutions rely on converters, services or transaction hubs answering to PDM interoperability industry business cases.

The goals of the PDM Implementor Forum are to:

- Develop international PDM interoperability recommended practices, completing the international PDM interoperability standards,
- Establish shared test activities in the PDM area, based on agreed and reliable methods,

The method of the PDM Implementor Forum is to:

- Agree on a list of prioritized use cases for PDM interoperability to be implemented by PDM editors and integrators:
 - Consider the high priority to focus first on simple solutions, covering 80% of the needs, but without endangering the extensions to more complex use cases.
- Develop PDM recommended practices, completing the standards, and facilitating the implementation of PDM interoperability applications / services by PDM editors,
- Validate implementations of PDM interoperability functionalities for today's needs,
- Identify functionalities for tomorrow's needs,
- Avoid roadblocks by establishing agreement upon PDM interface approaches,
- Take into account the parametrization and customization of PDM systems, affecting the level of interoperability with other applications,
- Increase user confidence by providing PDM system and STEP AP interoperability testing capabilities for the PDM area,
- Producing relevant and sharable test datasets, representative of actual practices and complexity of actual data,
- Ensure that new functionalities do not adversely impact existing implementations.

PDM-IF is characterized by five global principles:

1. Open to several industries: aerospace, automotive, shipbuilding, AEC, and others;
2. Common to all regions – Americas, Europe, Asia – in order to reach global markets, to be adopted by global PLM vendors, and to provide solutions to a world-wide supply chain;
3. Coverage of the full product life cycle: The PDM-IF will cover PDM interoperability, from the concept phase, the manufacturing phase, the maintenance phase, and the retirement phase.
 - Based on existing recommended practices, the work plan is proposed to be focused at first on the design phase and manufacturing phase, but the target is to develop a set of consistent PDM interoperability recommended practices covering all life cycle stages.
4. Coverage, by the progressive increasing scope, of the different implementation methods and technologies for PDM interoperability (Figure 1):
 - Priority 1: PDM data exchange and long term archiving,
 - Priority 2: PDM integration and sharing,
 - Priority 3: PDM linked data.
5. Use of the STEP PDM information models, covering the full product life cycle, as the root of the different implementation methods, as illustrated in Figure 2.

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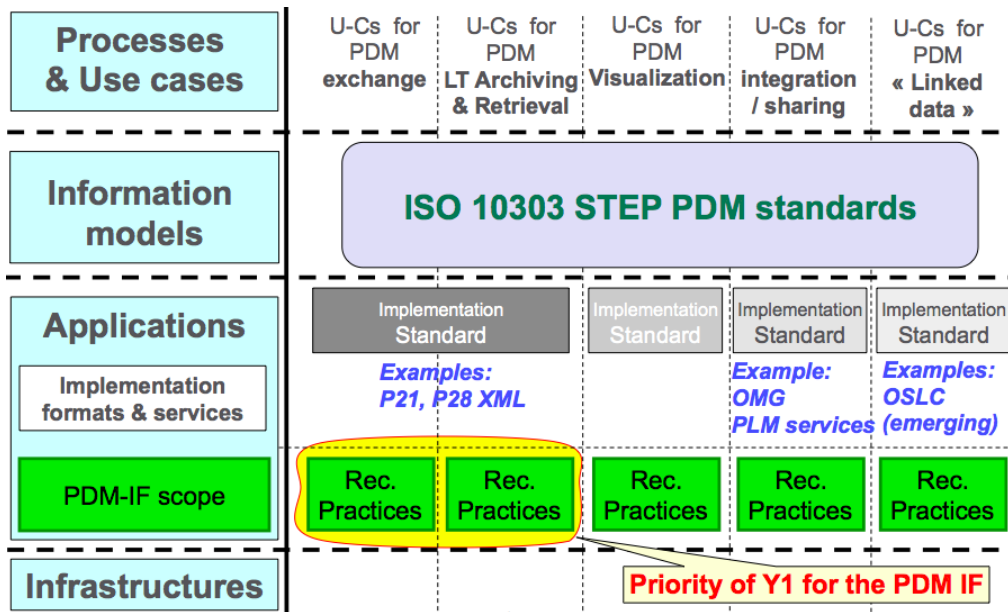


Figure 1 - PDM Interoperability: use cases, information model and associated implementation technologies

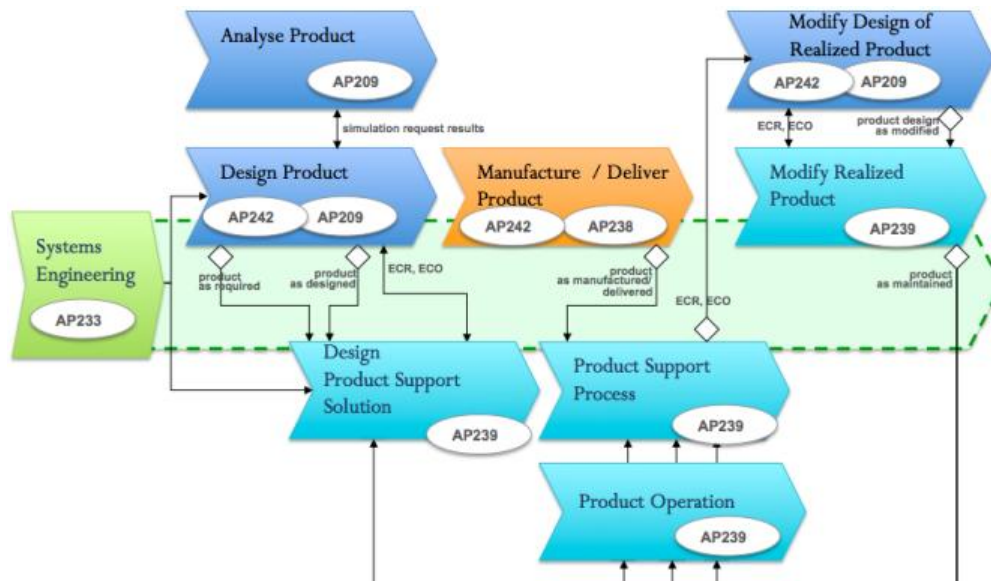


Figure 2 - STEP Standards distribution in function of product lifecycle

The PDM-IF will provide common guidelines for the PDM domain of the following STEP modular Application Protocols:

- AP 209 "Multi-disciplinary analysis and design",
- AP 233 "Systems Engineering",
- AP 242 "Managed model based 3D engineering", which is the convergence of AP 203 and AP 214 developed by the aerospace and automotive industry associations for a common ISO standard of PDM interoperability;
- AP 210 "Electronic assembly interconnect and packaging design",
- OASIS PLCS and AP 239 "Product Life Cycle Support".

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The PDM-IF will work in close coordination with:

- The other related Implementors Forums: CAx-IF, JT-IF, etc.
- The other related STEP standardization projects: Enhancement of the STEP standards (e.g., AP 233, AP 209, AP 210, AP 242, AP 239) according to PDM-IF feed back.

The STEP community has experienced successful harmonization projects in PLM standardization:

- Successful CAx Implementor Forum, led by PDES Inc and ProSTEP iViP since 1998;
- Creation of the International LOTAR Project and setting up of a successful organization with an increasing scope;
- STEP AP 203 and STEP AP 214 convergence and creation of STEP AP 242 standard, common to Aerospace and automotive.

However, while the PDM based exchanges in supply-chains have been identified as an important improvement stage, there is not anymore a dedicated place¹ to share recommended practices for the PDM area.

- ⇒ Need to set up a PDM-IF, otherwise each main industry stakeholder will develop unique recommended practices, and there will be conflicts of priorities of implementation by the PDM vendors, and a lot of additional costs for the distribution of the PDM information in the supply chain.

¹ PDM-IF created by ProSTEP iViP and PDES Inc in 2001-2002, for the development of the PDM usage guide for STEP AP 203 and STEP AP 214.

3 Terms and references

PDM data

PDM data deals with product data, being able to cover one or several phases of the product life cycle. PDM data can be managed by a PDM system. PDM data means data of product structure, document structure, file structure, classification, project context, person and organization, date and time, change management and configuration management.

PDM vendor/integrator

A PDM vendor is a company in charge of development, commercialization and support of a PDM software product. A PDM Integrator is a company providing applications or services on a certain PDM system, in order to ensure the communication with other applications.

PLCS: Product Life Cycle Support.

Technical Data Package (TDP)

A Technical Data Package is a coherent set of information in electronic format for specification, simulation, design, manufacturing or support to be exchanged, archived or shared within or between different organizations for a specific purpose.

4 Context of the start of the activity

4.1 PDM-IF in the industrial context

The global performance of the extended enterprise is a major progress factor in the Aerospace, Defence & Automotive industries. PLM has to meet the new needs. PDM interoperability intersects with all technical disciplines and life cycle stages. Therefore, it may be considered as one of the cornerstone of PLM interoperability. We can distinguish several stages of maturity in collaboration, according to characteristics such as:

- The collaboration mode: sequential or concurrent;
- The cycle time for one iteration of information;
- The status of information when it is shared: in progress, validated, approved;
- The type of the information: e.g., documents or drawings, 2D or 3D models, product structure (BOM);
- The format of the information: native or standard (e.g., Native CAD, IGES, DXF, STEP);
- The system used: single system, two homogeneous systems, two or more disparate systems.

The figure below illustrates PLM functions in parallel with extended enterprise integration maturity.

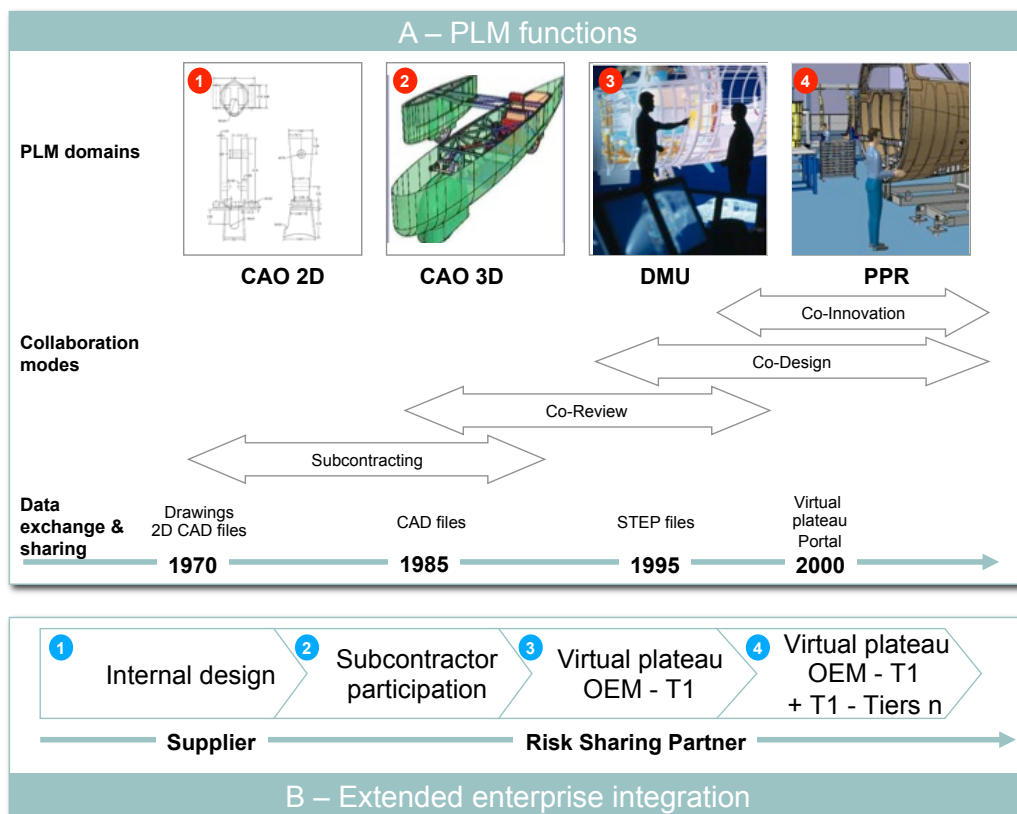


Figure 3 – PLM functions & extended enterprise integration evolution

Nota: PPR = Product Process Resources, DMU = Digital Mock-Up

All combinations of PLM functions and extended enterprise characteristics are possible, even if they are not all relevant. For example, some of the most frequently encountered profiles today are:

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- Drawing exchanges between identical CAD systems;
- Drawing exchanges between heterogeneous CAD systems using a standard;
- 3D Model exchanges between heterogeneous CAD systems using a standard;
- Configured 3D Models including PDM information exchanges between heterogeneous PLM systems using a standard;
- Physical plateau: Subcontractor is working with an OEM system on the OEM premises;
- Virtual plateau: Subcontractor is working from his own premises using a network, through an OEM system, which is located on the OEM premises; with the same technologies as a local OEM system, in which hardware is physically separate;
- On the Cloud Collaborative HUB: OEM, partners and subcontractors are working together on a shared PDM system, in which data is located on the Cloud, and is interoperable with their own systems using standards.

The trend in industries is to amplify the PDM information sharing between partners and through the supply-chain. It is proved that standards for product data models and process models are essential in order to enable exchanges and collaboration between partners or within a single enterprise backbone at an affordable cost.

PLM interoperability standards are specifications of product data models or process models. Multiple implementations of these standards by different users or vendors lead to different interpretations. This makes developments and implemented solutions of different actions incompatible, reducing interoperability, as illustrated in the figure below.

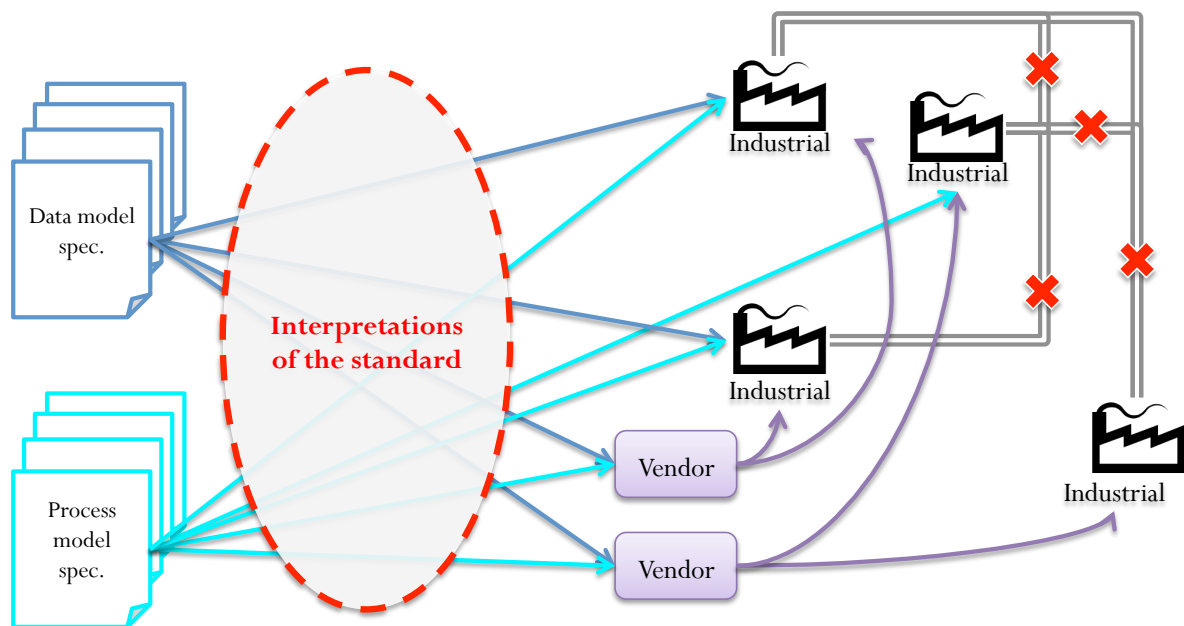


Figure 4 – Different Standard interpretations lead to breaches in PDM interoperability

With the PDM Implementor Forum, PDM implementation interoperability can be drastically increased by the use of common PDM recommended practices, validated by the industries and the PDM vendors, and by industrialization of test and validation processes, as illustrated in the figure below.

Definition of Recommended Practices: Recommended practices are documents or models, which describe the recommended structure and the attribute qualifications in building data models based on the entities, attributes, types and rules in STEP AP schemas. These documents significantly improve data exchange, sharing, integration and archiving when the implementation by integrators is based on recommended practices.

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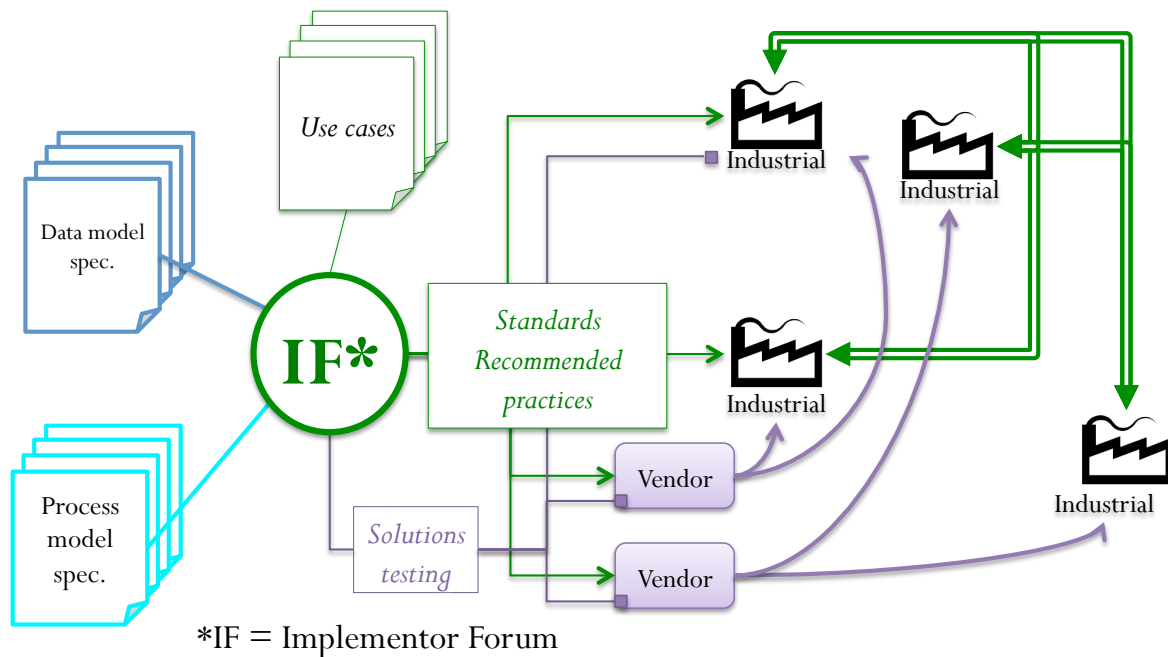


Figure 5 – PDM-IF can help solve PDM interoperability breaches

4.2 History of the PDM-IF

The creation of the first PDM-IF, by PDES Inc and ProSTEP iViP between 2001 and 2003, did not reach its initial goals as it faced many unforeseen challenges. The PDM implementations have suffered from the fact that PDM systems are based on specific customization of the PDM system databases and processes.

The main output of this initiative was the publication of the PDM-Schema, which has been used in industry for PDM based exchange scenarios providing common practices to implement the original AP 203 and AP 214, which are now superseded by AP242 and its extended scope.

Lessons learned – enhancements:

- Need for close collaboration between users and PDM vendors for agreed prioritized use cases and standard recommended practices,
- Differences between the future PDM-IF methods versus the CAX IF methods,
- Need for easy PDM exchange implementation for basic & frequent use cases,
- Need for the preparation of the PDM-IF project plan (deliverables, resources)
- Preparation of PDM test cases: production test model + syntactic test models,
- Difficulties when facing the customization of PDM applications and processes,
- Need for agreement on the methods and infrastructure of the PDM Recommended Practices.

4.3 On going standardization projects related to the PDM-IF

ISO 10303 standardization projects including PDM information

The PDM-IF will take into account the evolution of the following standards:

- AP 209 “Multi-disciplinary analysis and design”,
- AP 233 “Systems Engineering”,
- AP 242 “Managed model based 3D engineering”;

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- AP 210 “Electronic assembly interconnect and packaging design”,
- OASIS PLCS and AP 239 “Product Life Cycle Support”.

Aerospace projects (standards, Implementor forums)

There are several on-going projects that request the consolidation of the capabilities for the development, support and qualification of the PDM interoperability functionalities.

- ASD SSG “Through Life cycle” WG

A report, published in 2014, highlights the needs to speed up the creation of implementor forums, as key enablers for the maturity of operational solutions for PLM interoperability. The PDM-IF is identified as the first priority to tackle, since it is transversal to all the disciplines and product life cycle stages.

- LOTAR International PDM WG

This WG has confirmed the need for the development and maintenance of international PDM recommended practices for STEP AP 239 PLCS and AP 242. The standards alone results in some cases in different minor interpretations, damaging the efficiency of operational use.

The retrieval during 50 to 70 years of archived PDM information require to share common public PDM recommended practices, prerequisite to minimize the cost of maintenance of COTS solutions through the time.

The LOTAR PDM WG has also funded the PDM harmonization of STEP AP 242 ED1 and of OASIS PLCS PSM. The benefits of this initiative require also supporting the development, when meaningful, of harmonized PDM recommended practices for STEP AP 242 and AP 239 PLCS.

- AIA – ASD Integrated Logistic Support (ILS) Specifications projects

This project defines a suite of Specifications describing the processes and information models to be used for a certain domain of ILS. The Data Modeling and Exchange (DME) WG is in charge to develop the information model enabling the integration and communication between the different AIA – ASD ILS specifications. The target is to rely on STEP AP 239 ED3 PLCS, when it will be available. For the PDM exchange use cases related to the ILS processes (e.g., for maintenance feed back to engineering), it will require to use transversal PDM recommended practices.

- MOSSEC² project

The MoSSEC project is focused in the distribution and sharing of data sets between different multi-disciplinary simulation frameworks and between different partners. It defines a high level information model (Business Object Model), which is mapped on a underlying STEP AP 233 / AP 239 PLCS information model. It defines web services, and also specifies recommended practices (DEX) for STEP file exchanges.

Some of the templates and web services defined by the MoSSEC project will have to be consistent with other templates / web services defined by the PDM-IF (for example, persons & organizations, security, classification, document management, etc).

- Systems Engineering – Interoperability Forum (in preparation).

Joint Aerospace and automotive industries project to develop PDM recommended practices for STEP AP 242 standard.

² MoSSEC : (Modelling and Simulation information in a collaborative Systems Engineering Context)

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Aerospace and automotive industries have agreed to develop jointly the STEP AP 242 standard and their associated recommended practices for the shared use cases.

The CAx IF manages the CAx recommended practices for STEP AP 242. Initial works have started in S2 2014 to develop the recommended practices for AP 242 XML PDM basic attributes. But by lack of funding and time constraints, it was agreed to postpone the setting up of the PDM-IF.

Automotive project (standards, Implementor forums)

To be completed

4.4 Interested parties to the PDM-IF

This is not an exhaustive list and will need to be updated.

| | | | |
|---|--------------------------|--------------------------------------|-----------------------------|
| Aerospace industries | | Large PLM vendors | |
| European Aerospace manufacturers | | - PTC | Interest - to be confirmed |
| - Airbus | Confirmation of interest | - Dassault Systems | Interest - to be confirmed |
| - BAe | Confirmation of interest | - Siemens PLM | n/a |
| - Dassault Aviation | Confirmation of interest | SME PDM vendors / integrators | |
| - Snecma / Safran | n/a | - EPM Jotne | Confirmation of interest |
| - Thales | n/a | - Engesis | Confirmation of interest |
| American Aerospace manufacturers | | - Eurostep | n/a |
| - Boeing | Tentative | - Datakit | Interested - limited subset |
| - Embraer | Confirmation of interest | - Theorem | n/a |
| - Lockheed Martin | n/a | - Boost Conseil | Confirmation of interest |
| - General Electric | n/a | - Core Technology | n/a |
| Sponsoring associations | | Collaboration platforms | |
| - PDES Inc | Interested | - BoostAeroSpace | Confirmation of interest |
| - ProSTEP iViP | n/a | | |
| - AFNeT | Confirmation of interest | | |
| - GIFAS | Confirmation of interest | | |
| - ASD SSG | Confirmation of interest | | |
| - AIA | n/a | | |
| - NIST | To be confirmed | | |
| - VDA | n/a | | |
| - Galia | Confirmation of interest | | |
| - AIAG | n/a | | |
| Automotive industries | | | |
| - BMW | n/a | | |
| - Daimler | n/a | | |
| - Volkswagen | n/a | | |
| - PSA | Interested | | |
| - Renault | n/a | | |

n/a = information not available

Table 2 – DRAFT List of PDM-IF interested parties

5 Requirements from Industry

The requirements for the PDM-IF are listed according to the following sections:

- Aerospace and defence requirements,
- Automotive requirements,
- PDM vendors / PDM integrators requirements.

5.1 Aerospace and defense requirements

General scope

- Review and prioritization of use cases for PDM interoperability development and testing by the manufacturers associations,
- Development of PDM recommended practices (RP) for exchange, sharing, long term preservation, and linked data based on STEP modular Application protocols:
 - Ex: Priority 1 for the first year of the PDM-IF: Exchange of PDM unconfigured product structure.
- Basic qualification of COTS PDM interoperability functionalities of PDM vendors solutions, through PDM interoperability test rounds:
 - Establish and maintain a list of functionalities tested by the vendors during the PDM-IF test rounds,
 - Provide feedback to the standards developers to resolve any issues demonstrated through the test rounds,
 - No benchmarks will be provided by the PDM-IF.
- Maintenance of the PDM recommended practices.

Business Requirements

- To ensure consistency of PDM international recommended practices across the different domains (e.g., mechanical, electrical, system engineering, embedded software, etc.) and through the different life cycle stages (e.g., concept phase, preliminary design, design, manufacturing, support, etc.);
- To ensure upward compatibility for legacy PDM recommended practices;
- Communication and outreach:
 - Development of a public PDM-IF website to publish the deliverables (e.g.: PDM recommended practices), scope and planning of PDM test rounds,
 - Contribution to conferences,
 - Development and maintenance of the appropriated PDM-IF reference data libraries.
- PDM-IF infrastructure based on an open, web based, infrastructure;
- To cover progressively the different implementation PDM interoperability technologies, which are complementary, and shall rely on consistent PDM information models.

Management of the PDM-IF as a project

- Prioritization of Use Cases as input for the RP and PDM vendors development work plan and tests rounds; yearly project plan, budget and deliverables.
- Coordination co-chaired between EU and US under industry governance and with the help of technical management funded by manufacturers associations,
- Management of Liaisons with other standardization projects and other Implementors Forums:
 - Ex: Priority 1 for 2014 work plan: to ensure consistency between PDM and CAD recommended practices for assembly structure and product structure.
- V-lifecycle methods of System Engineering;
- Neither overhead nor operational change to existing organizations (ex: CAx-IF).

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Deliverables:

- Deliverables are expected to be publicly available once validated;
- Library of business scenarios & use cases linked to test cases;
- Public test cases / data sets, and associated quality control rules;
- Model based method for development and implementation of the Recommend Practices;
- Method and technology stack defined to produce the Recommend Practices;
- International PDM recommended practices
- Test infrastructure;
- Public Reference data library(ies) associated to the PDM Recommend Practices,
- Recommendation for PDM parametrization and customization of STEP AP 242 interfaces for facilitating interoperability.

5.2 Automotive requirements

- Harmonization/sharing of use cases between stakeholders such as software editors and company users that imply increased quality & cost and time reduction;
- Forum to exchange experiences and requirements about STEP PDM interoperability as well as related business cases;
- Long term archiving: Support SASIG LTAR recommendations, define archival classes of data and associated representation, and increase long term quality through embedded quality information.

5.3 PDM vendors / PDM integrators requirements

Priority 1:

- To have precise use cases and a list of priorities agreed by the industries associations;
- To limit the number of PDM standards to implement;
- Well documented stable test data sets with clear definition of the information sets;
- Publicly available repository of STEP files including test datasets, and others reference data library;
- The test methodology has to allow secured testing of confidential datasets;
- To provide precise and stable PDM recommended practices;
- Relationship between use cases and the PDM recommended practices needs to be well described;
- Propose initial testing at the core template level, and after full exchange (DEX) testing;
- To speed up the development of PDM STEP interfaces and increases the quality of PDM interoperability testing;
- To propose mechanisms to measure the quality of STEP data and STEP interfaces;
- Ability to evaluate STEP PDM information syntax and semantics;
- Develop a standard “error and result reporting” format, easy to understand;
- Forum to present and solve issues discovered during the implementation of the STEP interfaces.

Priority 2: Testing framework

- Provide a testing framework to allow ‘sandbox’ test environment;
- The framework is not just for PDM to PDM exchange, it is larger. There are use cases to exchange to PDM to ERP, CAD to PDM, etc.;
- Testing framework has to be able to support multiple PDM standards;
- Recommendation is to use a web-based framework. It has to support pre-process and post process export (view, read only, etc.);
- Vendors are able to run real tests using real world usage scenarios;
- Main vendor's data models are rich, with lots of metadata. Testing framework has to support that (no need to clean data in order to use the testing framework).

6 Benefits of and business drivers for an international PDM-IF

Establishing a unique organization to gather manufacturers, PDM vendors & integrators, and STEP experts to ensure the specification and qualification of PDM interoperability solutions based on prioritized use cases, will allow a higher PDM integration within the companies, including the case of: multiple PDM systems; communication between PDM and ERP; communication with the customer, and within the Extended Enterprise.

Other common benefits for PDM-IF members are:

- The development and maintenance of STEP modular Application Protocols, contributing to consistent evolution of STEP PDM standards, recommended practices and DEXs. The other identified benefits and business drivers are as follow.
- One benefit of the PDM-IF is the definition and governance of public RDL (reference data library) implementing international PDM recommended practices.

6.1 Benefits for stakeholders

User Organization Benefits:

- Stability of new capabilities;
- Early feedback on requirements;
- Shared costs for use cases / functions common to Aerospace & Automotive;
- Quicker availability of COTS STEP PDM interoperability solutions;
- Common infrastructure for multiple industries;
- Better quality with harmonized PDM Recommended Practices & interoperability testing;
- Better longevity of archived PDM data, with lower risks of divergence;
- Unique place for cooperation between different communities, common platform for testing PDM interoperability functionalities according to the recommended practices;
- Agreed Recommended Practices at international level will increase efficiency of the PDM process in the multi levels supply chain with increased quality and, cost and time reduction;
- Promote and facilitate the implementation of STEP PDM interoperability solutions in the supply-chains;
- Consistent PDM interoperability methods through the life cycle with:
 - System Engineering, Multi-disciplinary Analysis, Design, Manufacturing, Support.
- Qualification of PDM interoperable solutions.

6.2 Aerospace OEM Manufacturers point of view

General

- Higher integration within the companies;
- Multiple PDM systems, between PDM and ERP;
- Agreed Recommended Practices will increase higher efficiency of the PDM process in the multi levels supply chain with increased quality and cost and time reduction;
- Promote and facilitate the implementation of STEP PDM interoperability solutions;
- Forum to exchange experiences and knowledge about STEP PDM interoperability;
- Decrease the learning curve of implementing the STEP PDM standards;
- Environment where people will encourage the dissemination of common practices;
- May avoid divergence of recommended practices by separate consortiums (e.g., America and Europe, Aerospace and Automotive, etc.);
- Agreed planning and priority of implementation of PDM interoperability functionalities (by user communities and PDM vendors);
- Common platform for testing PDM interoperability functionalities according to PDM recommended practices;

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- Minimize the cost of migration of PDM systems;
- Facilitates the use of STEP PDM interoperability standards;
- PDM LT archiving:
 - Promotion of a common aerospace position for archiving of PDM data and testing the use cases in collaboration with the LOTAR activities;
 - PDM integration based on web services.

6.3 Automotive OEM Manufacturers point of view

One of the characteristics of the Automotive Supply or Value Chain is heterogeneity.

The quantity of partners on different projects running in parallel and using solutions of their choice (in-house included) in an always-shorter cycle time, leads to heterogeneity.

Therefore, PDM solutions have to support the diversity of configurations, teams and locations. This is the reason why it seems mandatory that both editors, integrators and product development organizations have to work together on solution requirements definition, based on real-life use cases, validate their implementation, and confirm their robustness in everyday life.

An international PDM-IF will contribute to time savings, providing quick access to best-of-class-solutions that take into account every standard (existing or to be developed).

For the greater benefit of all, the PDM-IF will:

- Promote and facilitate usage of PDM data exchange;
- Promote planning and priorities for the implementation of PDM interoperability functionalities (by users communities and PDM vendors).

6.4 Small and Medium Enterprise point of view

- « Similar » methods and applications for different customers;
- Broader and cheaper support of STEP PDM interoperability solutions.

6.5 PDM vendors and PDM integrators point of view

- Harmonized functionalities for the appropriate common use cases;
- Decrease of duplication of efforts without business added value;
- Testing Participants Benefits:
 - Testing in a closed, trusted environment by enabling each vendors to test their solutions themselves against reference models, services and recommended practices without being obliged to share the detailed results of their tests;
 - Early detection of errors leads to faster development cycles;
 - Beta-testing with other systems enhances product interoperability and robustness, even before production release;
 - User requirements are communicated, and common implementation approaches agreed.

7 Technical Principles of the PDM-IF and related motivations

This section describes the overview of the PDM-IF common technical principles concerning use case collection and formalization, recommended practices, and testing, which are detailed in PDM-IF Operations Manual document.

These principles are justified because they allow us to address identified issues which must be resolved if we want to reach the benefits identified in the previous section. They have been defined from the interoperability state-of-the-art, and from lessons learned from previous standardization projects. In particular, the way that standards and recommended practices are formalized has been assessed from the viewpoints of projects aiming to implement the standards, generated from a software provider point of view or PLM project point of view.

7.1 Main issues identified in regards of an efficient PDM-IF

Within the current PDM interoperability landscape, the main issues the industries are facing may be summarized as follows:

1. Validation of the standards is time consuming, and their quality is difficult to ensure;
2. Recommended practices are not standardized, and their application is difficult;
3. In most PDM implementations, the responsibilities of the PDM software providers and PDM users/implementors are not clearly defined;
4. Lack of configuration management of the standards and recommended practices increases the costs to set up interoperability between PDM applications;
5. Multiplication of heterogeneous standards, frameworks and processes, all of them out of ISO control, creates confusion and inconsistency in the PDM implementations;
6. Confusion between modelling languages and modelling artefacts leads to complex frameworks;
7. Development of PDM implementer forums per implementation technologies, with the risk of development of inconsistent PDM information models which creates issues, since the PDM implementation technologies are complementary and may be used in parallel.

7.2 Overview of PDM-IF technical principles

In order to address these issues, the PDM-IF will apply the following technical principles:

1. A standardized, model based approach shall be used for capturing and interrelating use cases, test scenarios, and recommended practices;
2. Ability of exchange/sharing on top of a parameterized/customized software product shall be considered in the use cases, test scenarios and recommended practices.
3. In order to manage the continuous evolution over the time, clear and precise roadmaps shall be defined, indicating which part of the standards, recommended practices, and test procedures shall be used;
4. An accurate set of modelling languages shall be defined and used to formalize use cases, test scenarios, and test reports;
5. PDM-IF recommended practices define, maintain and test classifications (e.g. product, process, organization, etc.) based on document and on Reference Data Library.

8 General scope through the main tasks, covered use cases and deliverables

For PDM-IF, the set of PDM interoperability use cases to address will have to be collected, for which the recommended practices will be produced. The used PDM information models (e.g. AP242 BO model, AP242 AIM, etc.) and data formats (e.g. XML, P21, P28) will have to be explicitly stated in the use cases. In addition, if PDM RDL are concerned, the used data format will also have to be explicitly stated (e.g. RDF-XML, Express + P21, etc.). Finally, if use cases include usage of PDM web services (e.g. OMG’s Web Services) for data sharing, the language used in implementation for defining the services will have to be explicitly stated. Figure 6 - Links and layers from processes to STEP formats illustrates what is to be captured, as a prerequisite for clear definition of activities and work planning.

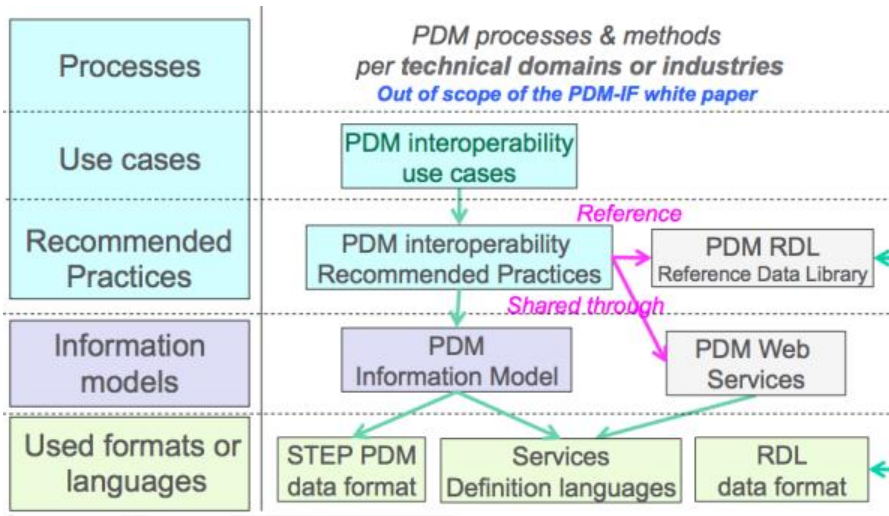


Figure 6 - Links and layers from processes to STEP formats

The PDM-IF procedure figure below is illustrating the main activities, their interdependencies, related deliverables and associated participants. Groups of participants are described in Project management chapter.

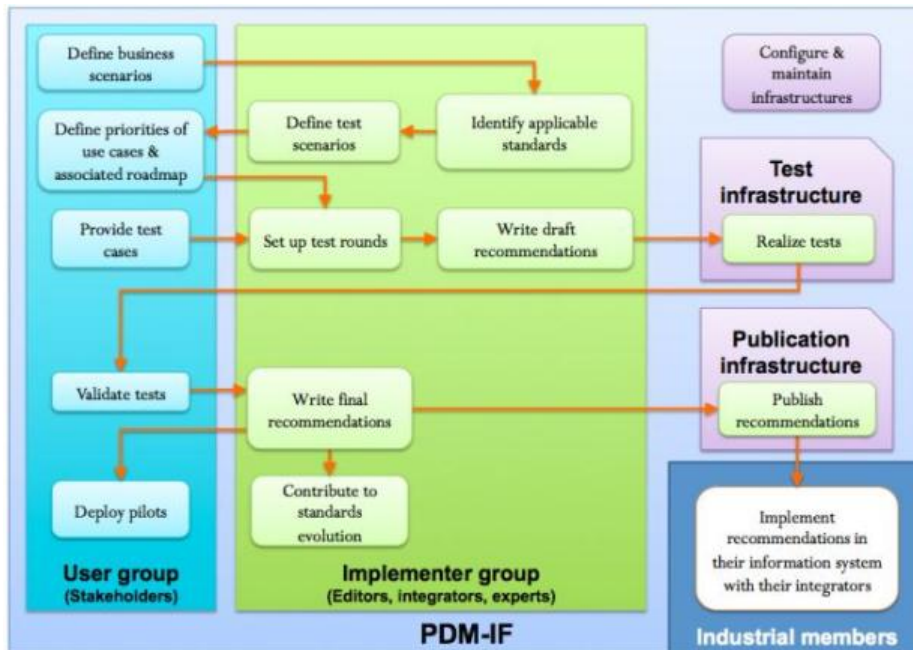


Figure 7 - PDM-IF procedure

8.1 Main tasks

The activities of the PDM-IF are organized into the following four main tasks. These tasks and their technical details are precisely presented in the PDM-IF Operations Manual document.

1. Description of use cases and prioritization for implementation

This task is detailed in the following chapters: a first proposed list of usage scenarios and use cases is described in part 8.2. The proposed principles for the description method of the PDM interoperability use cases are described in PDM-IF Operations Manual, part Management and description of PDM interoperability use cases.

2. Development and maintenance of PDM recommended practices

Based on the use case prioritization, the development and maintenance of PDM recommended practices covers the following:

- The prioritization of the applicable PDM standards and of the implementation methods to be tested;
- The harmonization and consistency of the PDM recommended practices for the different application protocols that can be used for Product Data Management exchange, sharing, integration and Long Term Archiving (AP209, AP210, AP233, AP239, AP242).

3. Interoperability testing and associated test rounds

Interoperability testing and associated test rounds will cover the following:

- The creation of the use case derived tests scenarios with associated process, key indicators (e.g. metrics) and test data sets;
- Implementation testing through test rounds which are supported by solution providers and integrators;
- For each round, collecting and analysing the results in order:
 - To define how to implement the tested PDM standard until interoperability is achieved for addressed use cases;
 - To identify limits and change needs for the standard.
- To derive and develop from the gain experience PDM Recommended Practices that ensure interoperability for the addressed use cases;
- The governance with the ISO/TC 184/SC 4 of the interdependencies between the PDM information models standards and the PDM recommended practices and use cases.

4. Publication, outreach, coordination and communication

Publication, outreach and coordination covers the following:

- The publication of the validated recommended practices, reference data sets, and test reports;
- Outreach to industry, vendors, integrators, and education organizations;
- Coordination with the standardization bodies, projects and other Implementor forums, presented in part 9.2.1 Coordination with standardization projects.

Communication: The project will communicate regularly the status of progress of the different tasks to the related involved parties. It includes more specially:

- Monthly conference calls of the leadership, testing participants, and user groups;
- 4 meetings per year based on test rounds.

The project will create and maintain:

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- A list of distribution (E-mail exploders);
- Web-based secure PDM-IF team portal with file sharing;
- A public web-site to promote the PDM-IF through information dissemination:
 - « Evangelisation » for STEP PDM interoperability,
 - Business benefits,
 - Success stories,
 - High level principles,
 - Target for a public web site for end of Year 1.

The following is out of scope for the PDM-IF:

- The benchmarking of STEP PDM interoperability:
 - « Presentation of merits of solution »
 - Sensitive and « political » aspects
- The development of standards for PDM interoperability,
- The harmonization of PDM information model standards, which is under the responsibility of the ISO TC 184/SC 4.

8.2 Use cases covered by the PDM-IF and first proposed list of use cases

There are several categories of PDM interoperability use cases: PDM data exchange, long term archiving, etc., allowing to select a STEP protocol and its information model depending on the product life cycle segment. Several technologies and file formats of the recommended practices have also to be distinguished and defined. There are generic use cases, common to all industries, and specific use cases that are closely related to business processes and products of a company or an industry: important customization and parameterization of the PDM systems shall be considered.

Consequently some use cases must be prioritized: during the life of the PDM-IF, the roadmap of recommended practice development will be defined by use case priorities and the availability of standards. The list of prioritized use cases will be defined by the PDM-IF User Group. The PDM-IF Operations Manual document details the proposed prioritization method.

The use case scope of PDM-IF is: **PDM data exchange, PDM data long term archiving, PDM data integration/sharing, and PDM linked data.**

In the context of AP242 IS publication, the first list of priority one Use Cases identified by industry and PLM vendors is based on the AP242 PDM exchanges:

- Use case A: Explicitly Configured “as designed” PDM product structure exchanges as **single AP242 BO Model XML** file referencing **3D CAD models** (in STEP or other CAD format) with validation properties in XML;
- Use case B: Explicitly Configured “as designed” PDM product structure exchanges as **single AP242 BO Model XML** file referencing **documents**;
- Use case C: Explicitly Configured “as designed” PDM product structure exchanges as **fully shattered AP242 BO Model XML** file referencing **3D CAD models** (in STEP or other CAD format) with validation properties in XML.

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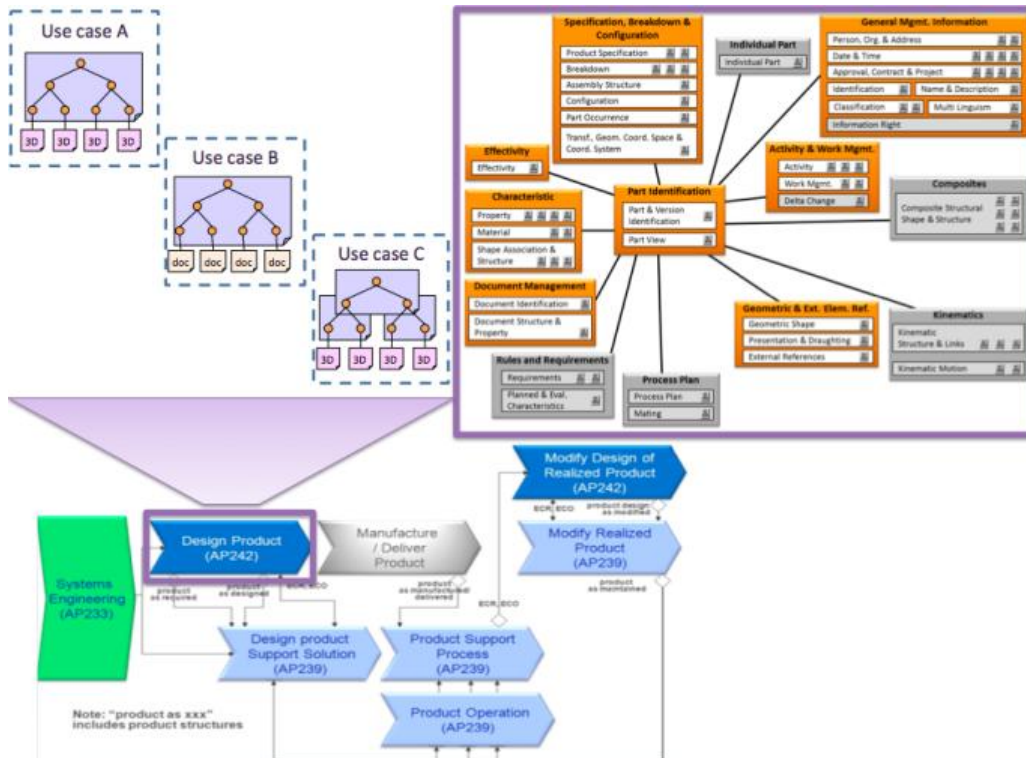


Figure 8 – Use case A, B and C positioned in regards of the STEP AP242 ed.1 BO Model Capabilities

One objective is to provide consistent and complementary use cases. Another objective is to highlight differences between PDM exchange and PDM integration / sharing based on PDM web services.

The proposed principles for the description method of the PDM interoperability use cases are described in the PDM-IF Operations Manual document.

8.3 Deliverables

The main deliverables of the PDM-IF are:

- Industry Use Cases,
- Recommended Practices,
- High level testing plan,
- General testing instructions,
- Test suite/test cases,
- High level testing results, publicly available,
- Detailed testing results, privately available,
- Feedback to standard developers.

9 Project management

This chapter presents:

- Project organization,
- Project plan,
- Coordination with standardization project,
- And the financial principles.

A more detailed description of the project management is described in the Operations Manual

9.1 Project organization

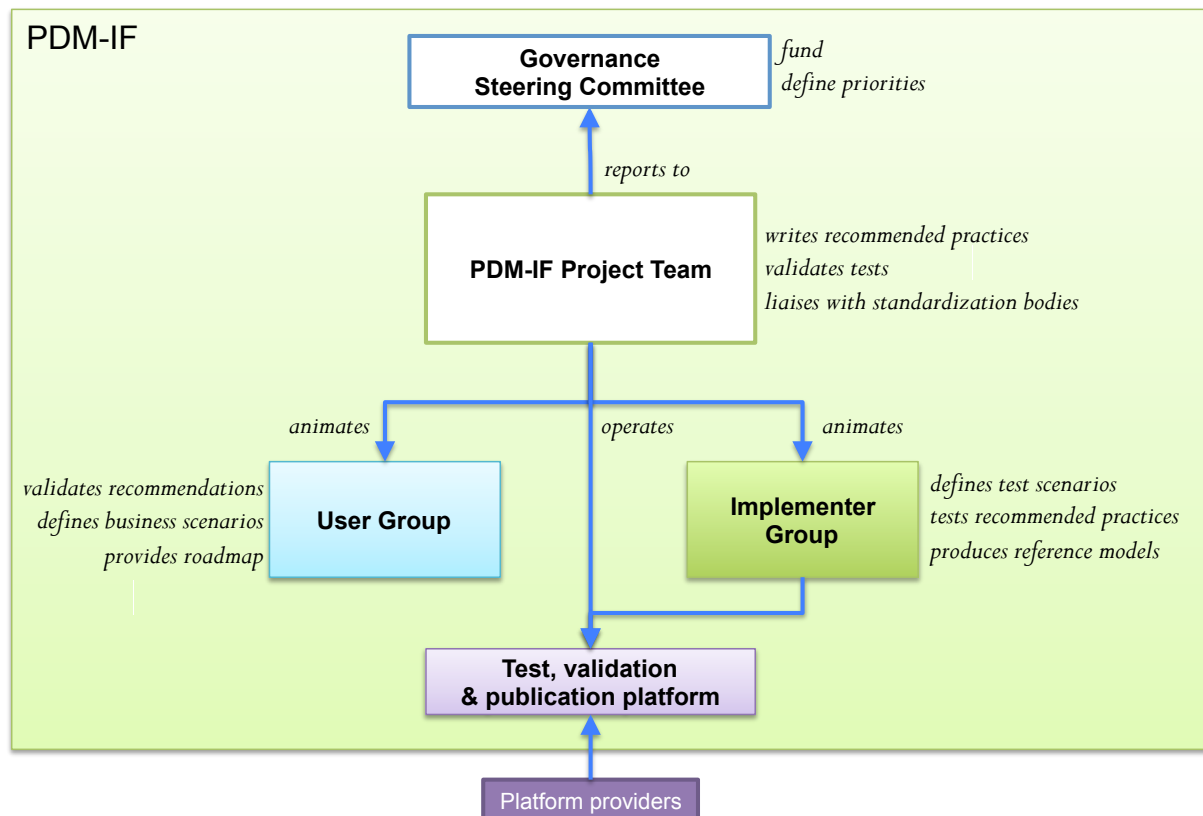


Figure 9 – Project organization and governance

The PDM-IF is organized around 2 main constituents: the **User Group** and the **Implementor Group**.

The **User Group** represents the industry stakeholders and ensures that the industry needs are taken in account with the correct priorities by the standardisation activities as well as with the implementation testing. The User Group defines the business scenarios, the implementation roadmap in function of priorities and standards availability based on Implementor Group's recommendations.

The **Implementor Group** is in charge of developing the recommended practices to answer the industry needs and of testing the implementations.

In order to facilitate the group's activities, the **Project Team** is in charge of managing the operational activities of the groups, meetings, test activities, edition and publication of the recommended practices, communication and outreach. The governance of the activities will

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be managed by a **steering committee** in charge of defining the priorities and provide the necessary funding to the PDM-IF.

The test and the publication infrastructures will be supported by a platform providing test services, publication services, access control and more. This platform is detailed in the PDM-IF Operations Manual document.

9.2 Project plan

A 3-year roadmap is needed. The project is managed on a yearly plan and deliverables: recommended practices, reports and publications. Work plan is organized the following way: an agreed list of prioritized use cases shall be provided each year. Work program is flexible year over year and driven by manufacturers business needs from which the use cases are defined, knowing that target is one recommended practice defined in 1 year (see figure of PDM-IF schedule below): two test rounds per year, recommended practice updated after each test round and new use case started at the end of year N.

For the 1st year, the tentative project plan is defined in the "First year project plan proposal" document. The first use case to be considered is use case A: Explicitly Configured "as designed" PDM product structure exchanges as single AP242 BO Model XML file referencing 3D CAD models (in STEP or other CAD format) with validation properties in XML.

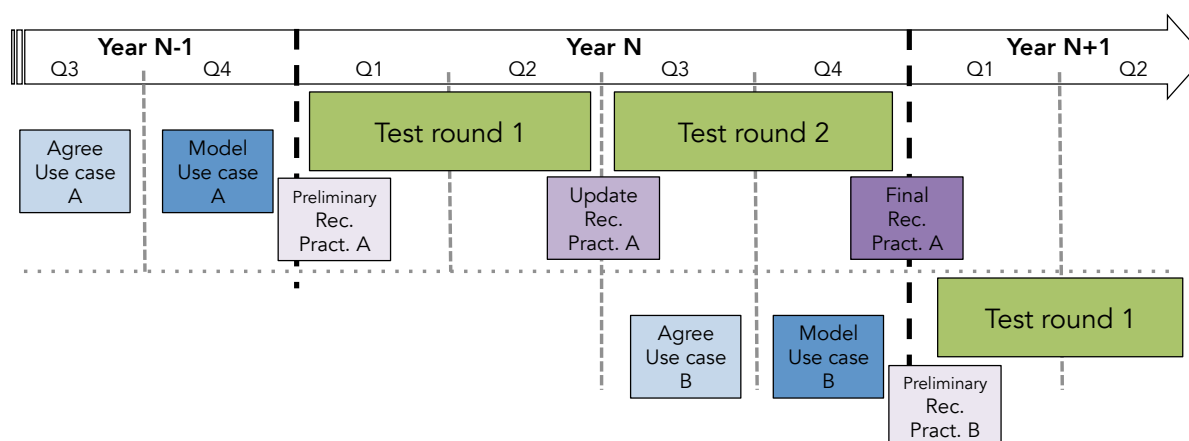


Figure 10 – Yearly PDM-IF schedule

9.2.1 Risk management

During the life of the PDM-IF, risks will be identified and analysed as they occur. Mitigation strategies will be developed. Risks will be reviewed on a regular basis by the Steering Committee.

9.3 Coordination with standardization projects

One task of the PDM Implementor Forum is the coordination with the different kinds of standardisation projects. The objectives of the coordination are:

- To provide the precise scope, the defined priority and followed status of each project;
- To share the progress, the best practices and the lesson learnt of each groups;
- To highlight the opportunities of coordination between 2 or more implementor forums for cross-domain use cases.

In the following subparts, the different kinds of projects are introduced:

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- Coordination with information models standardization projects,
- Coordination with PDM data sharing standardization projects,
- Coordination with LT archiving & retrieval of PDM data project,
- Coordination with the other Implementor forums.

The figure below provides an overview of the organizations involved in the PDM-IF and their coordination links.

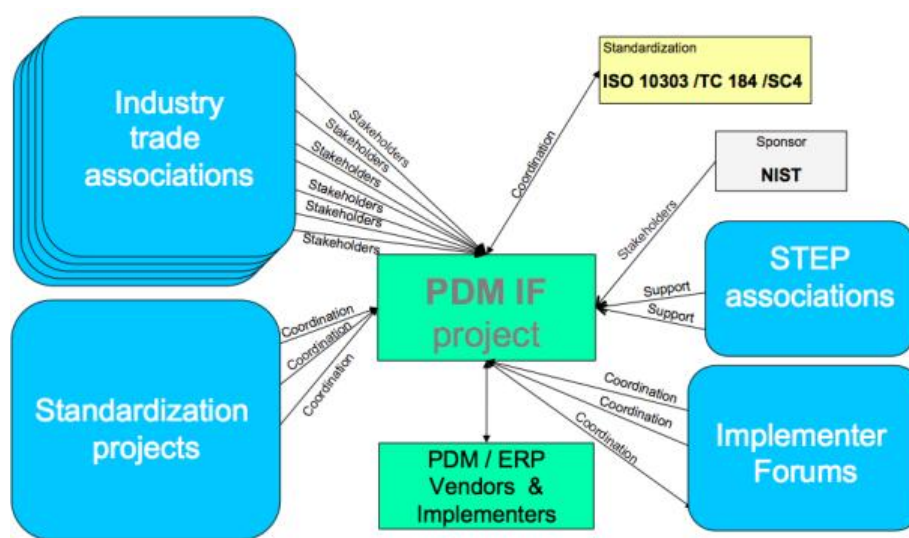


Figure 11 – Organization environment of the PDM-IF Project

The PDM-IF community is made of:

- The PDM-IF members;
- The chairman of the other related Implementer Forums;
- Representatives of the trade associations, e.g. AIA EEIC, ASD SSG, VDA, Galia, Jama, AIAG, SASIG, GIFAS, etc.;
- Representative of the STEP associations, e.g. PDES Inc, ProSTEP iViP, AFNeT, etc.;
- Representatives of the ISO /TC 184 /SC 4, in charge of the development of the STEP Application protocols.

The PDM-IF community have coordination meetings or conference calls at least 2 times per year.

9.4 Financial principles

Activities are funded by fees paid by Users companies and related associations.

The PDM-IF shall be a lightweight structure as the industry is already spending lots of energy on the standardisation activities themselves.

Breakdown of the costs by the main PDM-IF activities:

1. Prioritization of Use Cases
2. Edition and publication of recommended practices
3. Interoperability testing and results (variable accordingly to business involvement)
4. Management, communication and coordination with other projects

Based on the existing Implementor Forums there are 5 main cost centers: the project management, the international meetings, the recommended practices edition, the test infrastructure, the interoperability tests, and the associated communication actions.

Parts of these costs are already covered by the participants' contributions to the Implementor Forum activities: travel costs for the participants, and contributions of the vendors to the test activities.

What is left is the cost of the project team, in charge of: managing the meetings, editing the recommended practices, organizing the test rounds, and publishing the results on one side, and on the other side: the maintenance and operations of the publication infrastructure and the test infrastructure.

There is a base cost for PDM-IF activities such as: the groups meeting management (physical and digital meetings), the publication infrastructure, the test infrastructure, the communication and coordination with other groups.

On top of this base cost there are additional cost of editing an individual recommended practices, realize the necessary test and validation rounds with the Implementor Group and publish the reports.

The financial principles should allow the funding of recommended practices based on priorities from the industry. Each year, a set of recommended practice shall be evaluated in terms of estimated costs and needed resources.

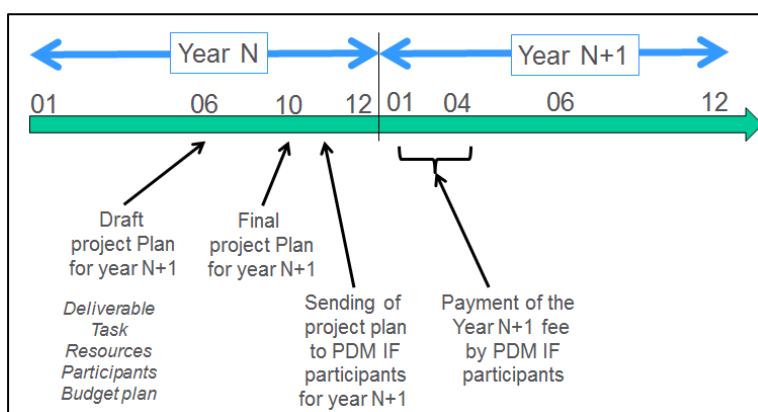


Figure 12 - Planning for the preparation of a yearly PDM-IF project plan

The draft project plan for Year N+1 is defined in June of Year N. The PDM-IF members have to pay the fee of Year N in the 4 first months of Year N.

10 Summary - next actions

This document reminds the importance of the setting up of the PDM-IF for the industries in order to minimize the costs of operational use of communication and interoperability of PDM information.

With the generalization of deployment of PLM processes, methods and applications in the different manufacturing industries, the lack of efficient solutions for PDM information³ interoperability between heterogeneous applications is a source of delay and additional costs.

The PDM-IF aims at defining recommended practices completing the international PDM interoperability standards, for PDM exchange, long term archiving, integration and linked data shared through the internet.

The present white paper describes the context of this initiative, summing up the industries requirements and main business drivers.

It defines the scope and main tasks of the project. The management of priorities will be driven by prioritized use cases, agreed by the User community. Then the implementer Forum community, with representatives of the industries, and the support of PDM interoperability experts, will develop and review the PDM recommended practises; the PDM vendors and integrators will then carry out PDM interoperability test rounds with 2 main objectives:

- Validation of the PDM interoperability recommended practices,
- Testing of their PDM interfaces and services, increasing the quality of their applications, and speeding up the availability of solutions for the industries.

The priority for the first year will be the development of recommended practices for the use case: exchange of Explicitly Configured “as designed” PDM product structure, in STEP AP242 BO Model XML, with external references to 3D CAD models (in STEP or other CAD format).

The white paper describes the project organization and the management rules. It is completed by a second document "**PDM Implementer Forum Operations Manuals**", which details the technical aspects and procedures of the PDM-IF, once launched.

This PDM-IF will be consistent with:

The final prioritization will be confirmed by the stakeholders committed to support the PDM-IF project with the appropriate resources, once the white paper is published.

The main next actions are as follows:

1. The official confirmation of participation of the associations, manufacturers, PDM vendors and integrators 2 months after publication of the PDM IF white paper,
2. Organization of a kick off meeting of the PDM-IF user group 3 months after publication, aiming at:
 - Setting up the project and reviewing the operations manual,
 - Confirming the availabilities of resources for the first year,
 - Validating the priorities of activities for the first year.
3. Organization of a kick off meeting of the PDM-IF Implementer Group 5 months after publication,

³ PDM information: it includes mainly the product structure, document management, change management and configuration management information, through the different product life cycles, completed by associated information such as persons and organizations, classification, security and traceability.

White paper for the creation of a PDM Implementor Forum

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