

Cross-industry interoperability framework based on semantics technology

Industrial semantic interoperability summit 2026

DNV Høvik, Oslo, Norway, 2026-06-09/11

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The Arrowhead fPVN project is supported by the Chips Joint Undertaking and its members, including the top-up funding by Sweden, Finland, Denmark, Spain, Italy, Rumania, Portugal Hungary,



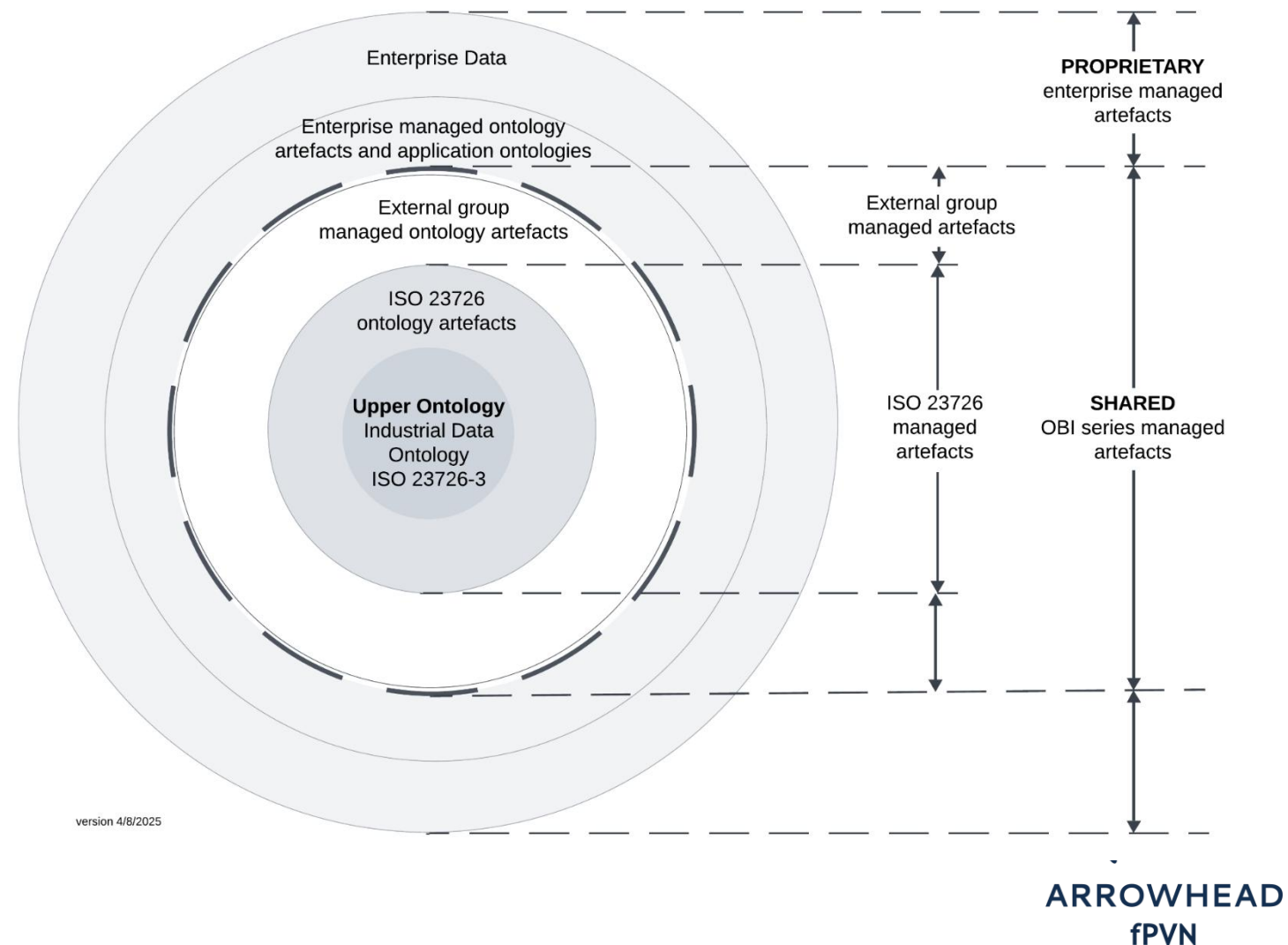
Objectives

- The main objective of Arrowhead fPVN is **improved productivity** of the European industry
- Arrowhead fPVN includes:
 - Aerospace industry
 - Automotive industry
 - Process industry
- Non-interoperability between stakeholders and machines caused by **heterogeneous data models is a bottleneck for improved productivity**
- Main objectives of Arrowhead fPVN WP3:
 - Select major standardized data models **relevant to the use cases** in Arrowhead fPVN
 - **Identify the foundational properties** of the selected data models
 - **Identify similarities and dissimilarities** between the standardized data models
 - **In cooperation with WP4** propose updates to the selected standard **to support a common cross-industry interoperability framework**

Description of work for AfPVN WP3

ISO 23726 OBI ecosystem

- WP3 has developed proposals for extending the selected industrial data models **to support a common cross-industry interoperability framework**
- A **semantic technology approach** has been used **based on the ISO 23726 OBI ecosystem**
- Facilitating **Semantic interoperability** and partly **Pragmatic interoperability**
- The findings have been applied to multiple use cases and to **create a White Book/Handbook** (best practices & guidelines)



Selected standardized industrial data models (1)

Standards in the WP3 work program and tested in AfPVN use-cases:

- **ISO 23726:** Ontology based interoperability (OBI)
 - **ISO 23726-1:** Overview and fundamental principles
 - **ISO 23726-3:** Industrial Data Ontology (IDO)
- **ISO 10303:** Product data representation and exchange (STEP)
 - **ISO 10303-239:** Product life cycle support
 - **ISO 10303-242:** Managed model-based 3D engineering
- **ISO 15926:** Integration of life-cycle data for process plants including oil and gas production facilities
 - **ISO 15926-2:** Data model
 - **ISO 15926-4:** Core reference data
- **DEXPI:** Data Exchange in the Process Industry
- **CFIHOS:** Capital Facilities Information Handover Specification
- **SysMLV2:** Systems Modeling Language
- **AFO:** Arrowhead Framework Ontology – Developed in cooperation with WP2 and WP4 and tested in Use Case 2.9

Selected standardized industrial data models (2)

Standards in the WP3 work program but not tested in AfPVN use-cases:

- **AAS:** Asset administration shell
 - **IEC 63278:** Asset administration shell (**AAS**)
- **DPP:** Digital product passport standards
 - **EN 18216:** Digital product passport - Data exchange protocols
 - **EN 18219:** Digital product passport - **Unique identifiers**
 - **EN 18220:** Digital product passport - **Data Carriers**
 - **EN 18221:** Digital product passport - data storage, archiving, and data persistence
 - **EN 18222:** Digital Product Passport - Application Programming Interfaces (APIs) for the product passport lifecycle management and searchability
 - **EN 18223:** Digital Product Passport - **System interoperability**
 - **EN 18239:** Digital Product Passport - access rights management, information system security, and business confidentiality
 - **EN 18246:** Digital product passport - Data authentication, reliability and integrity
- **IMF:** Information Modelling Framework

Proposal for updates of major industrial data models

- For each of the standards the report includes:
 - Scope of the standard
 - Short description of our work including cooperation with the standards organization
 - **Methodes used**
 - **Results**
 - **Proposed further work**
- The report also contain:
 - Enabling Semantic Interoperability Across Engineering Standards
 - **Discussion**
 - **Conclusion**
 - References
- The report will be available when it is approved by Chips JU

The Arrowhead fPVN Handbook on industrial semantics – Using IDO as upper ontology

- The following documents contain the Arrowhead fPVN project's handbook for data modelers applying IDO:
 - Guidelines: A quick-start reference to the below documents. Start with this one if you are new to the concepts.
 - Handbook: Full rationale, methodology, ontology architecture, and pattern library overview.
 - Patterns: Normative, per-pattern specifications with reusable OWL and SHACL structures.
 - Use Cases: Worked examples: DEXPI pump lifecycle, power transformer, CFIHOS Semantics, and others.
- The handbook are available at: <https://docs.posccaesar.org/libraries-and-standards/arrowhead-handbook/>
- It will also be available on the Arrowhead fPVN web

Cooperation with standards organization

WP3 has cooperated with several standards organizations:

- **ISO/TC 184/SC 4 Industrial Data**, see <https://www.iso.org/committee/54158.html>. SC 4 is responsible for three standards that are used in AfPVN:
 - ISO 10303: Industrial automation systems and integration — Product data representation and exchange
 - ISO 15926: Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities.
 - ISO 23726: Automation systems and integration — Ontology based interoperability.
- **DEXPI – Data Exchange in the Process Industry**, see <https://dexpi.org/>
- **CFIHOS – Capital Facilities Information Handover Specification**, see <https://www.jip36-cfihos.org/>
- **OMG – Object Management Group**, see <https://www.omg.org/>
 - SysML Systems Modeling Language
- **We have also worked closely with the Norwegian DISC – Digitalization-Industrialization-Standardization-Collaboration project**, see <https://wix.posccaesar.org/pages/partners/disc>

Joint working groups have been established with all these organizations

OBI – IDO Training sessions held in 2024, 2025 and 2026

Objectives:

- Provide necessary **ISO 23726-3 IDO** training of **modelling and subject matter experts**
- **Build an OBI community**
- **Report results** from the cooperation between the projects:
 - Arrowhead for Flexible Production Value Networks (Arrowhead fPVN)
 - DISC
 - Industrial Data Ontology (IDO)
 - Schedule data ontology (SDO)
- 23 sessions have been held
- Between 35 and 70 participants at each session
- Recordings are available on YouTube: <https://www.youtube.com/@POSCCaesarAssociation> and for fVPN members on https://atmospheres.research.ltu.se/owncloud/index.php/apps/files/?dir=/Arrowhead-fPVN/WP3%20Major%20standardised%20data%20models/Task3.2/OBI-IDO_Training&fileid=3411240
- Presentations are available at: <https://www.posccaesar.org/articles/new-obi---ido-training-sessions-2026>



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Sessions in 2026

In the period April-June, eight sessions were held covering the following topics:

- **ISO 10303: Semantic STEP**, Torbjörn Holm
- **Ontology development on the PCA platform – Maintenance Agency for IDO**, Lars D. Berthinussen and Arne Måge
- **Life cycle for IDO** – Aligned requirements, Heiner Temmen, Onno Paap and Torbjörn Holm
- **IDO: Industrial data ontology** - Dirk Walther, Johan W. Klüwer and Pål Rylandsholm
- **SysML: SysML v2 for Semantic Interoperability**, Géza Kulcsár
- **CFIHOS Semantics**, Onno Paap
- **DEXPI**, Heiner Temmen and Torbjörn Holm
- **SDO: Schedule data ontology** - Mihaly Fekete, Erik Danielsson, Dirk Walther and Lillian Hella

Sessions in 2025

In the period January-March, five sessions were held covering the following standards:

- **CFIHOS: Capital Facilities Information Handover Specification**
 - Presentation of CFIHOS Semantics 2025-01-24 (Onno Paap)
 - CFIHOS - Q/A and discussions 2025-01-31 (Peter Townson and Onno Paap)
- **IMF: Information Modelling Framework**
 - Presentation of IMF 2025-02-14 (Jann Slettebakk and Ove Heitman Hanssen)
- **DEXPI: Data Exchange in the Process Industry**
 - Deep dive in version 1.4 2025-02-28 (Dr. Gregor Tolksdorf and Heiner Temmen)
 - DEXPI – Process 2025-03-07 (Dr. Gregor Tolksdorf and David Cameron, Ph.D)

Sessions in 2024

In the period September-December, ten sessions were held covering the following standards:

- **DEXPI:** Data Exchange in the Process Industry
 - Presentation of DEXPI – 2024-09-13 (Heiner Temmen)
 - Discussion of selected parts of DEXPI – 2024-09-27 (Heiner Temmen)
- **IDO:** ISO 23726-3 Industrial Data Ontology
 - Presentation of ISO 23726-3 Industrial Data Ontology (IDO) – 2024-09-20 (Dirk Walther)
 - Discussion of selected parts of IDO – 2024-09-27 (Dirk Walther)
 - Presentation of IDO Draft International Standard (DIS) proposal – 2024-11-29 (Pål Rylandsholm and Johan Wilhelm Klüwer)
 - How to model properties, a deep dive into ISO/DIS 23726-3 Annex B.2 IDO and suggestions how to cope the challenge between expressivity and data integration based on IDO – 2024-12-06 (Andreas Neumann)
- **STEP:** ISO 10303 Product data representation and exchange
 - Presentation of the ISO 10303-239/242 Standards 2024-10-11 (Torbjörn Holm)
- **Model of a pump** - 2024-10-18:
 - DEXPI (Dirk Walther)
 - ISO 10303-239/242 (Judith Crockford)
 - ISO 23726-3 IDO (Dirk Walther)
- **CFIHOS:** Capital Facilities Information Handover Specification
 - Presentation of CFIHOS 2024-11-08 (Peter Townson)
 - Presentation of CFIHOS Data Model – 2024-11-15 (Jason Roberts)