DEXPI Data Exchange in the Process Industry

Evaluation of international standards

Outcomes of the PIDMIC congress at ACHEMA 2022

DEXPI Networking

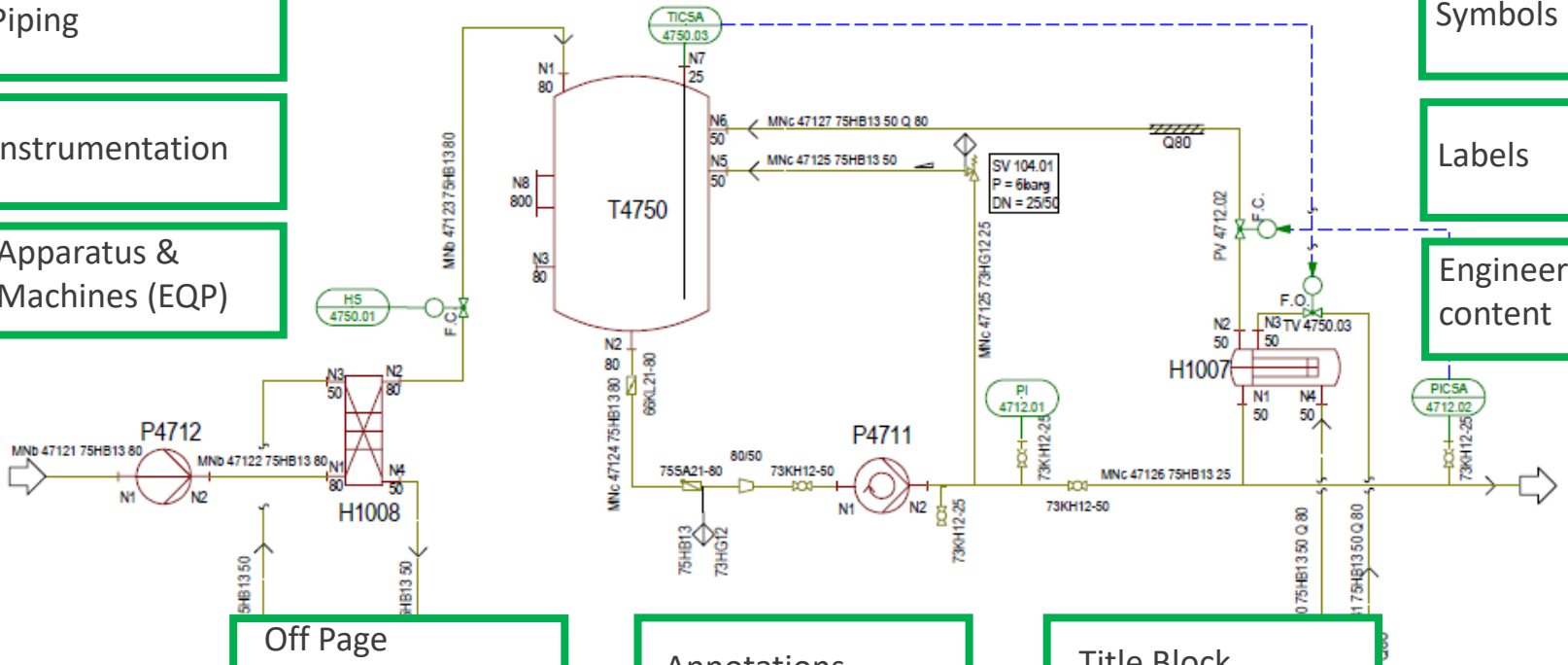
Michael Wiedau, Evonik/DEXPI

P&ID main components

Piping

Instrumentation

Apparatus & Machines (EQP)



Symbols

Labels

Engineering content

Off Page Connectors

Annotations

Title Block

DEXPI members overview

DEXPI Data Exchange in the Process Industry

International *Multi Sides Team*

Owner / Operators

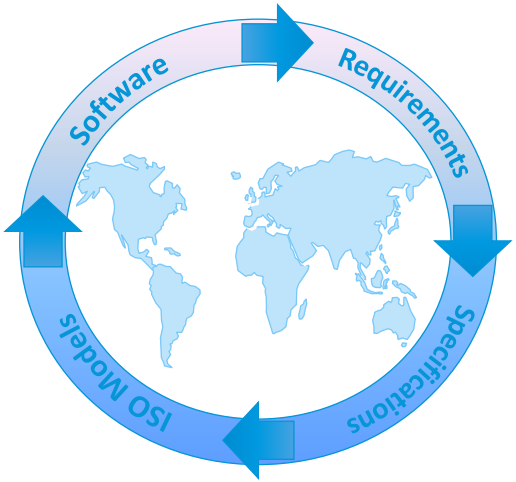
- BASF
- Bayer
- Covestro
- Equinor
- EVONIK
- Merck
- Wacker
- Shell

EPC

- Air Liquide

Software Vendors

- Autodesk
- Aucotec
- Aveva
- Cadmatic
- Bilfinger
- Hexagon
- PTC
- Semantum
- Siemens
- Sirfull



Research Organizations

- AixCAPE e.V.
- VTT of Finland
- TU Berlin
- RWTH Aachen University
- Tecgraf/PUC Rio
- A-Star

Support

- Plants & Bytes

International Community

- ISO TC 184 SC4
- CII / FIATECH
- OPC Foundation
- CFIHOS, THTH
- DECHEMA / NAMUR / DKE / VDMA
- SSG

ACHEMA2022

22 - 26 August 2022 | Frankfurt, Germany

PIDMIC

Process Industry Data Model Integration Congress

DEXPI® Data Exchange in the Process Industry

Interoperability Eco System

DEXPI@ACHEMA

DEXPI Data Exchange in the Process Industry

DEXPI@ACHEMA

Schedule PIDMIC Workshop

Day 1 – Tuesday, 2022-08-23

- 09:30 Welcome (Bazzanella, Wiedau, Meyer-Rössl)
- International standardization working bodies (Moderation: Meyer-Rössl)
  - 09:45 ISO (Sandsmark, van Exel)
  - 10:15 IEC (Temmen)
  - 10:45 Industry 4.0 / AAS (Grüner)
  - 11:15 OPC-UA (Hoppe)
  - 11:45 break
- General Industry solutions (Moderation: Phuong Mike Tran)
  - 12:00 CFIHOS (Townson)
  - 12:30 DEXPI (Wiedau)
  - 13:00 ECLASS (Temmen)
  - 13:30 Lunch break
- Industry Solutions with discipline focus (Moderation: Townson)
  - 14:30 VDMA (Faath)
  - 15:00 USPI – FL3DMS (te Lintelo)
  - 15:30 Break
- Solutions in preparation (Moderation: Temmen)
  - 15:45 DEXPI+ (Tolksdorf)
  - 16:15 ISO 15926 Part 14 (Sandsmark)
  - 16:45 JIP 33 datasheets (Townson)
  - 17:15 USPI tagging (Thostrup)
- 17:45 Closing of day 1 (Wiedau)

Day 2 – Wednesday, 2022-08-24

- 09:30 Review of day 1 (Meyer-Rössl)
- Additional user reviews (Moderation: Ingebrigtsen)
  - 09:40 SEIIA (Molin)
  - 10:10 THTH (Marttinen)
  - 10:40 CII (Meyer-Rössl)
  - 11:00 NAMUR (Schüller)
  - 11:30 break
- Workshop sessions – Part 1
  - 11:45 Gap analysis, conflicting approaches, other issues
  - 12:45 Lunch break
- Workshop sessions – Part 2
  - 13:45 Common View
  - 15:15 break
- Workshop sessions – Part 3
  - 15:30 Roadmap, Milestones, Todos
  - 17:00 Break
- Closing (Moderation: Meyer-Rössl)
  - 17:15 Feedback round
- 17:30 End

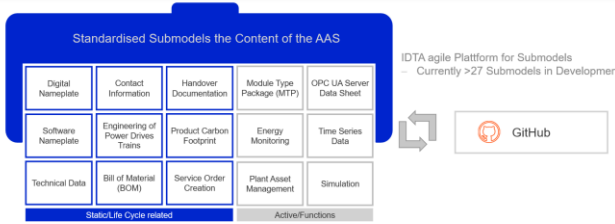
PIDMIC – Day 1 – Session 1

International standardization working bodies (Moderation: Meyer-Rössl)

- 09:45 ISO (Sandsmark, van Exel)
- 10:15 IEC (Temmen)
- 10:45 Industry 4.0 / AAS (Grüner)
- 11:15 OPC-UA (Hoppe)
- 11:45 break

Standardised Submodels: Open Source on GitHub

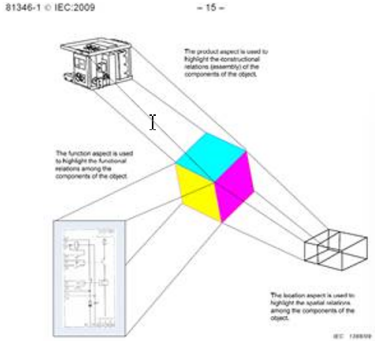
IDTA



ISO / IEC 81346 – decomposition approach

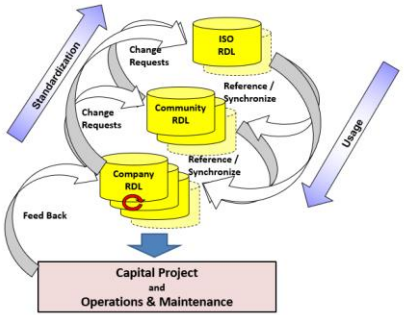
International Electrotechnical Commission

IEC



The RDL architecture ISO 15926

Envelop concept TC 184/SC 4/WG 3/22



23 Aug 2022 ISO Matters PIDMIC 17

OPC UA + Companion Specs = Promize for Industrial Interoperability

OPC UA Pub / Sub | OPC UA Security | OPC UA + CS Certification | OPC UA TCP | OPC UA over MQTT | OPC UA over APL / TSN | Modelling

OPC UA: Collection of technology bricks

- Discovery, Connectivity, different protocols like TCP, UDP, MQTT, ..
- Security, built-in by design, end-to-end
- Information modeling capabilities

+

Companion Specifications: Collection of bricks for different markets

- Information modelling to describe specific market
- Field devices need TCP, UDP, Safety, Motion, real-time, ...
- Gateway & Cloud services need UA over MQTT, 5G

Robotic Pumps ...

=

OPC UA + Companion Spec guarantee 100% Interoperability

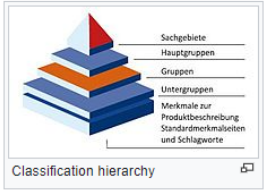
- Mandatory bricks guarantee interoperability
- Optional bricks allow flexibility
- OPCF: Tools and infrastructure for certification

OPC FOUNDATION

PIDMIC – Day 1 – Session 2

General Industry solutions (Moderation: Phuong Mike Tran)

- 12:00 CFIHOS (Townson)
- 12:30 DEXPI (Wiedau)
- 13:00 ECLASS (Temmen)
- 13:30 Lunch break



Classification hierarchy

The ECLASS classification system is based on a hierarchical grouping of products and services. There are 4 levels of hierarchy:[5][6]

- Segments,
- Main group,
- Group,
- Sub-group or product class.

This classification provides a grouping from point of view of purchasing.[7]

A product class has a 1:1-relation to an application class. Application classes are described in further details with properties according IEC 61360.[5] This approach separates the definition of the classification hierarchy from the definition of the product descriptions.

CFIHOS Elements

Technical Specification Document
Requirements, rules and principles for information handover

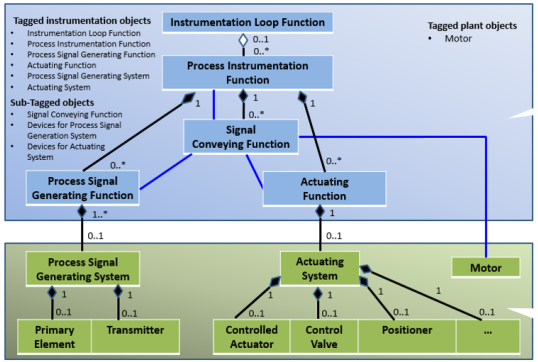
Data Model
For structuring data and documents about assets

Process & Guidance Documents
Outlining implementation steps (and do's & don'ts)

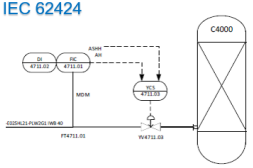
Reference Data Library (Dictionary)
Consistent naming of equipment, properties & documents

DEXPI – Instrumentation Model

DEXPI Data Exchange in the Process Industry



based on:
IEC 62424

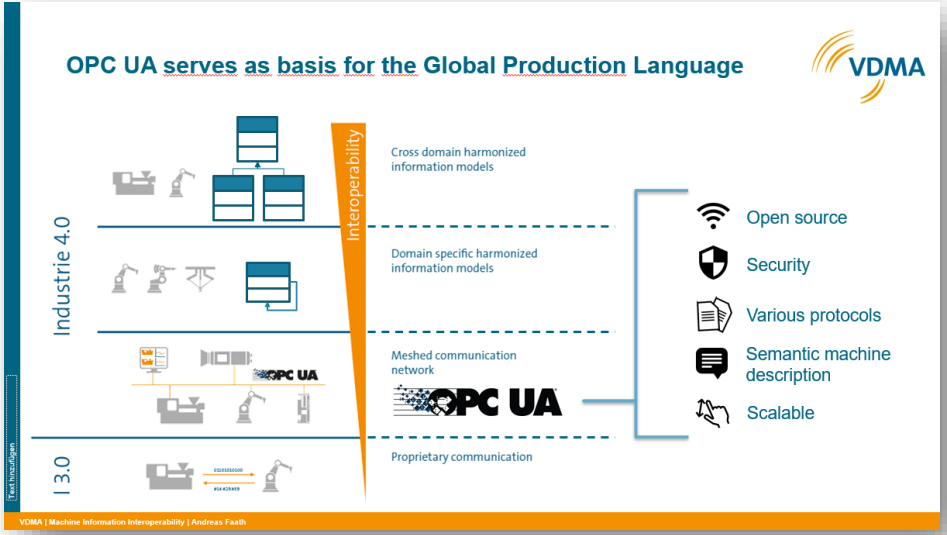


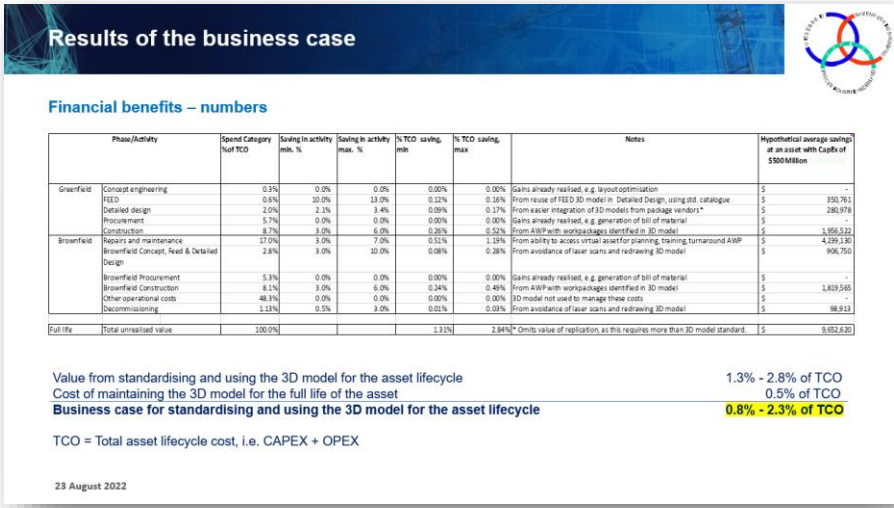
based on:
IEC 61987
(NE 100)

PIDMIC – Day 1 – Session 3

Industry Solutions with discipline focus (Moderation: Townson)

- 14:30 VDMA (Faath)
- 15:00 USPI – FL3DMS (te Lintelo)
- 15:30 Break



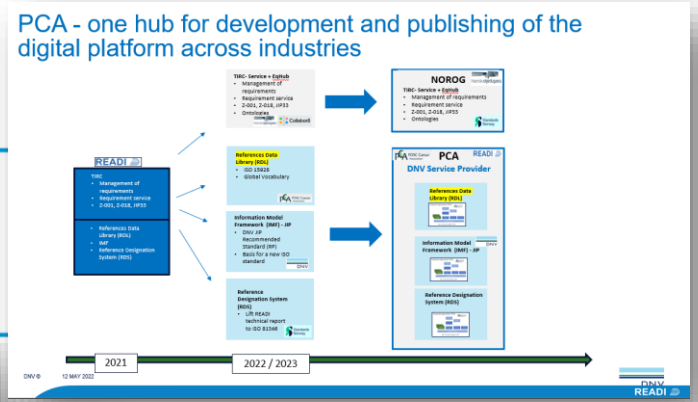


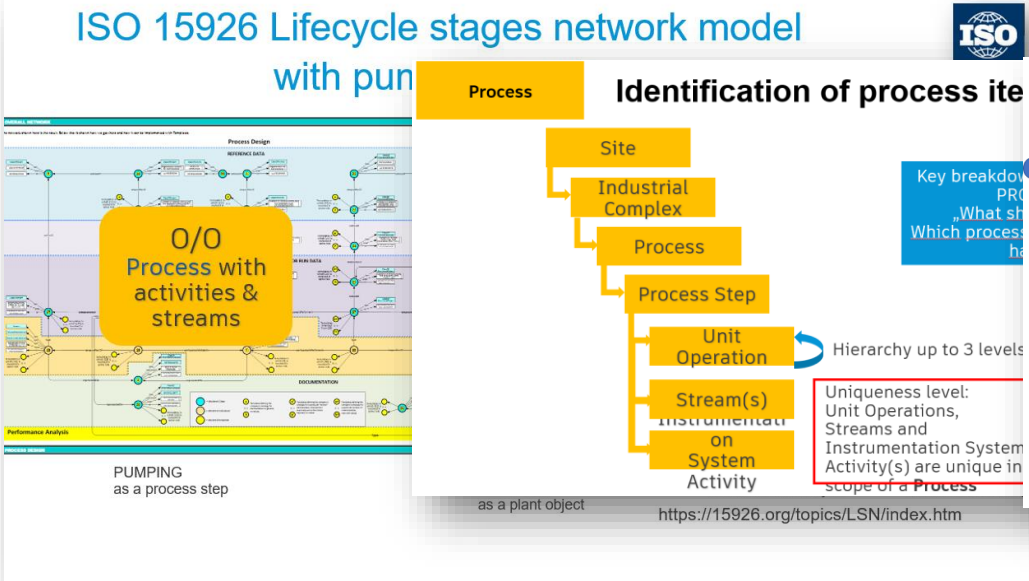
Phase/Activity		Spend Category %of TCO	Saving in activity min. %	Saving in activity max. %	% TCO saving, min	% TCO saving, max	Notes	Hypothetical average savings at an asset with Capex of $500 Million
Greenfield	Concept engineering	0.3%	0.0%	0.0%	0.00%	0.00%	Gains already realised, e.g. layout optimisation	$ -
	FEED	0.6%	10.0%	13.0%	0.12%	0.16%	From reuse of FEED 3D model in Detailed Design, using std. catalogue	$ 350,761
	Detailed design	2.0%	2.1%	3.4%	0.09%	0.17%	From easier integration of 3D models from package vendors*	$ 280,978
	Procurement	5.7%	0.0%	0.0%	0.00%	0.00%	Gains already realised, e.g. generation of bill of material	$ -
	Construction	8.7%	3.0%	6.0%	0.26%	0.52%	From AWP with workpackages identified in 3D model	$ 1,956,522
Brownfield	Repairs and maintenance	17.0%	3.0%	7.0%	0.51%	1.19%	From ability to access virtual asset for planning, training, turnaround AWP	$ 4,239,130
	Brownfield Concept, Feed & Detailed Design	2.8%	3.0%	10.0%	0.08%	0.28%	From avoidance of laser scans and redrawing 3D model	$ 906,750
	Brownfield Procurement	5.3%	0.0%	0.0%	0.00%	0.00%	Gains already realised, e.g. generation of bill of material	$ -
	Brownfield Construction	8.1%	3.0%	6.0%	0.24%	0.49%	From AWP with workpackages identified in 3D model	$ 1,819,565
	Other operational costs	48.3%	0.0%	0.0%	0.00%	0.00%	3D model not used to manage these costs	$ -
	Decommissioning	1.1%	0.5%	3.0%	0.01%	0.03%	From avoidance of laser scans and redrawing 3D model	$ 98,913
Full life	Total unrealised value	100.0%			1.31%	2.84%	* Omits value of replication, as this requires more than 3D model standard.	$ 9,652,620

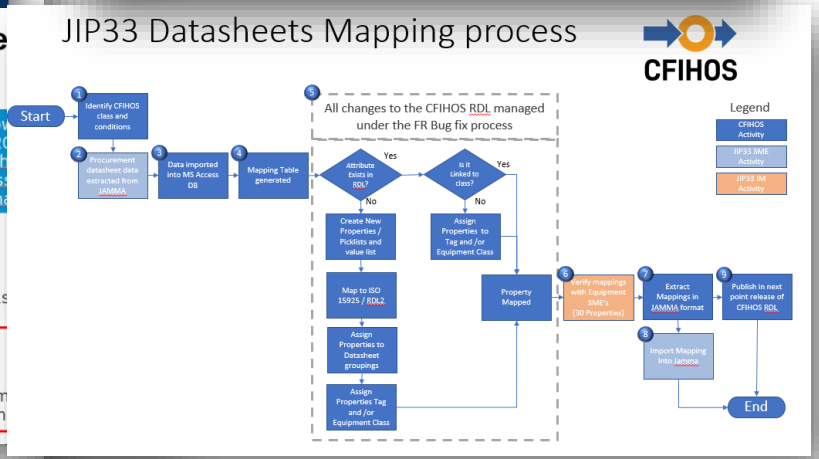
PIDMIC – Day 1 – Session 4

Solutions in preparation (Moderation: Temmen)

- 15:45 DEXPI+ (Tolksdorf)
- 16:15 ISO 15926 Part 14 (Sandsmark)
- 16:45 JIP 33 datasheets (Townson)
- 17:15 USPI tagging (Thostrup)



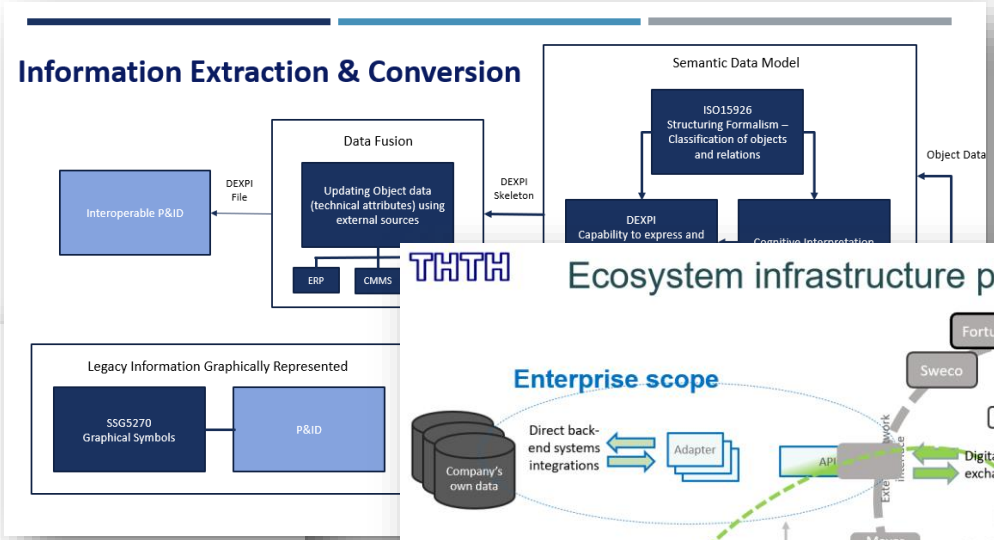


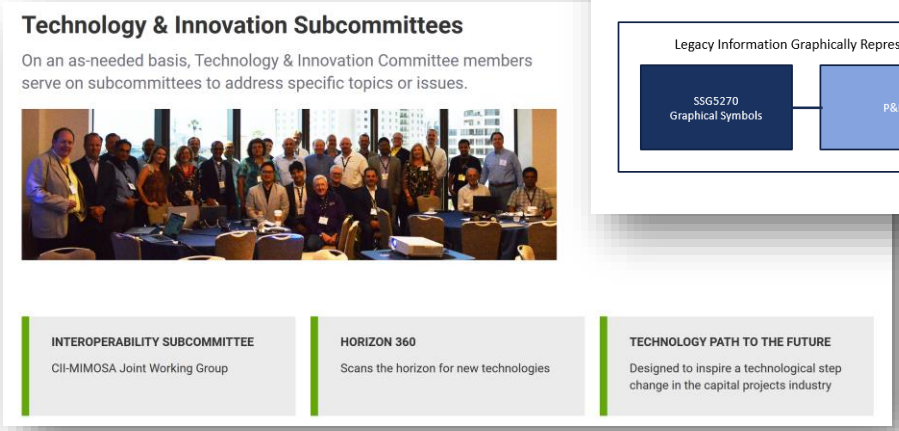


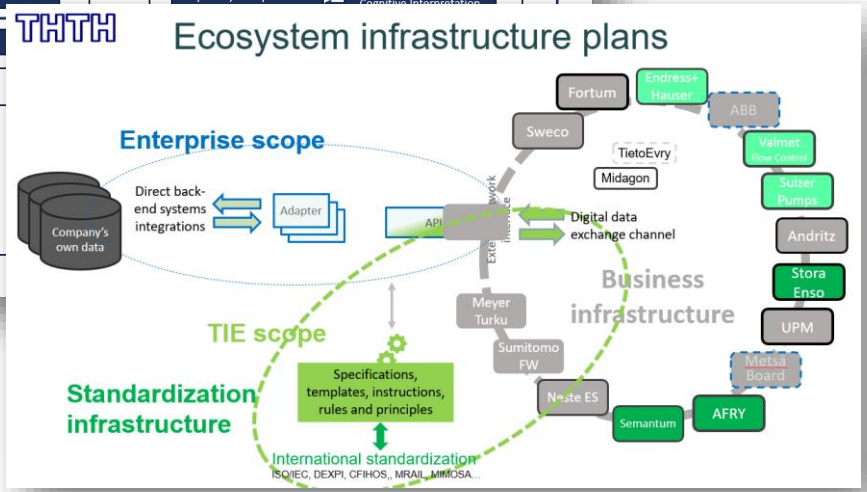
PIDMIC – Day 2 – Session 01

Additional user reviews (Moderation: Ingebrigtsen)

- 09:40 SEIIA (Molin)
- 10:10 THTH (Marttinen)
- 10:40 CII (Meyer-Rössl)
- 11:00 NAMUR (Schüller)
- 11:30 break







Day 2 – Working Session 1

GAP Analysis - Results

Alignment	Anzahl
fully aligned	6
partly aligned	28
not aligned yet	38
no alignment necessary	12
unknown	6

Alignment: not aligned yet — Anzahl 38

1	005	Group 4	JIP33 to CFIHOS	I 4.0 /AAS
2	008	Group 4	JIP33 to CFIHOS	OPC UA
3	012	Group 3	DEXPI+	I 4.0 /AAS
4	018	Group 4	JIP33 to CFIHOS	ECLASS
5	019	Group 3	DEXPI+	ECLASS
6	020	Group 3	DEXPI+	VDMA
7	021	Group 2	VDMA	I 4.0 /AAS
8	024	Group 4	JIP33 to CFIHOS	VDMA
9	029	Group 1	ISO	ECLASS
10	030	Group 2	VDMA	CFIHOS
11	031	Group 1	ISO	VDMA
12	033	Group 3	ISO 15926 part 14	IEC
13	035	Group 4	JIP33 to CFIHOS	NAMUR
14	036	Group 3	ISO 15926 part 14	I 4.0 /AAS
15	044	Group 1	IEC	CFIHOS
16	045	Group 4	JIP33 to CFIHOS	FL3DMS
17	053	Group 3	ISO 15926 part 14	NAMUR

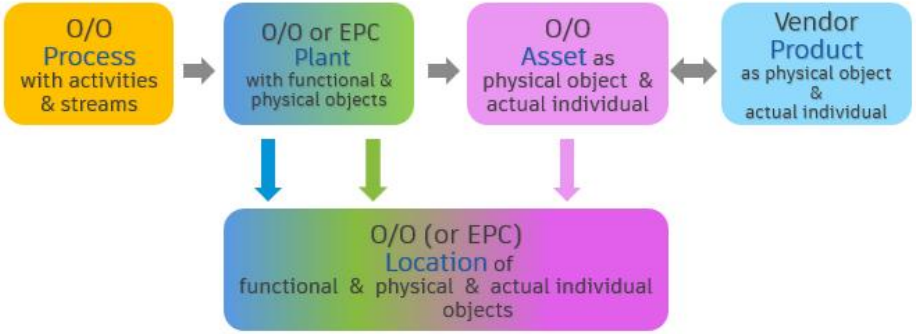
Working Session 1: Overlapping and alignment

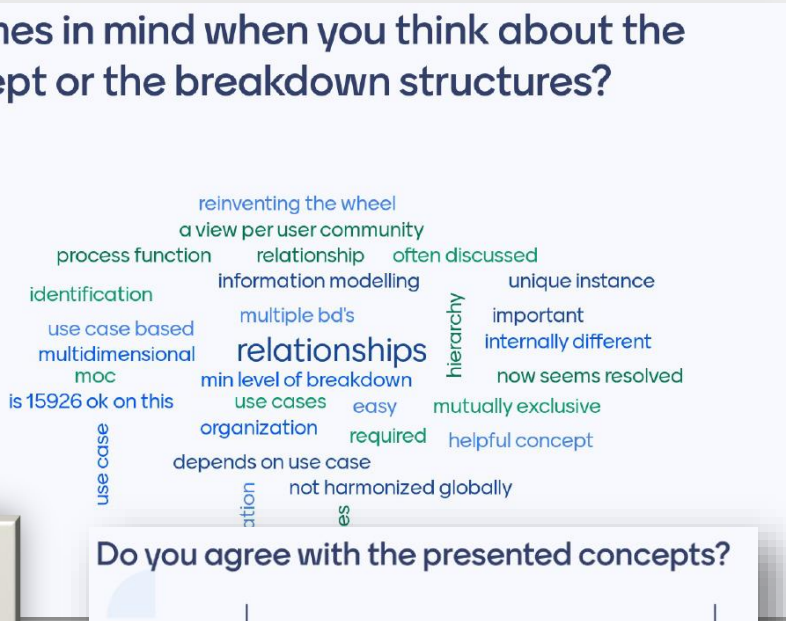
	ISO	IEC	I 4.0 /ASS	OPC UA	CFIHOS	DEXPI	ECLASS	VDMA	NAMUR	FL3DMS	DEXPI+	ISO 15926 part 14	JIP33 to CFIHOS	USPI Tagging
ISO		partly	not	?	partly	partly	partly	partly	not	partly	partly	fully	partly	?
IEC	partly aligned		partly	partly	partly	partly	partly	?	partly	not	not	partly	partly	?
I 4.0 /ASS	not necessary	partly aligned		partly	partly	partly	partly	not	partly	not	partly	partly	partly	not
OPC UA	?	partly aligned	?		partly	partly	partly	not	partly	not	not	not	not	not
CFIHOS	partly aligned	not aligned yet	?	not aligned yet		partly	partly	partly	partly	not	partly	partly	partly	partly
DEXPI	partly aligned	partly aligned	partly aligned	partly aligned	partly aligned		partly	not	partly	not	fully	partly	partly	partly
ECLASS	not aligned yet	partly aligned	not aligned yet	not aligned yet	not aligned yet	not aligned yet		?	partly	partly	partly	not	fully	not
VDMA	not aligned yet	partly aligned	not aligned yet	partly aligned	not aligned yet	partly aligned	?		not		partly	not	partly	partly
NAMUR	partly aligned	partly aligned	fully	partly aligned	?	partly aligned	partly aligned	partly aligned		partly	partly	partly	partly	partly
FL3DMS	partly aligned	not necessary	not aligned yet	not aligned yet	fully	fully	not aligned yet		not aligned yet		not	partly	partly	partly
DEXPI+	partly aligned	not necessary	not aligned yet	not necessary	partly aligned	fully	not aligned yet	not aligned yet	fully	not necessary		partly	not	partly
ISO 15926 part 14	fully	not aligned yet	not aligned yet	not necessary	partly aligned	partly aligned	not necessary	not necessary	not aligned yet	not aligned yet	not aligned yet		partly	?
JIP33 to CFIHOS	not aligned yet	partly aligned	not aligned yet	not aligned yet	partly aligned	partly aligned	not aligned yet	not aligned yet	not aligned yet	not aligned yet	not necessary	partly aligned		partly
USPI Tagging	not aligned yet	not aligned yet	not necessary	not necessary	not aligned yet	not aligned yet	not necessary	not aligned yet	not aligned yet	not aligned yet	not aligned yet	?	not aligned yet	

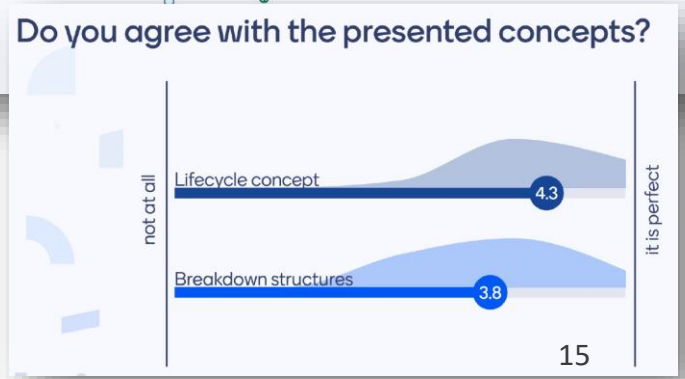
Green	overlapping	fully (subset)	Red	aligned	fully
		partly			partly
		not			not
					?

Day 2 – Working Session 2

Common View







Modelling rules

DEXPI Data Exchange in the Process Industry

How to describe data models?

Which resources should be used?

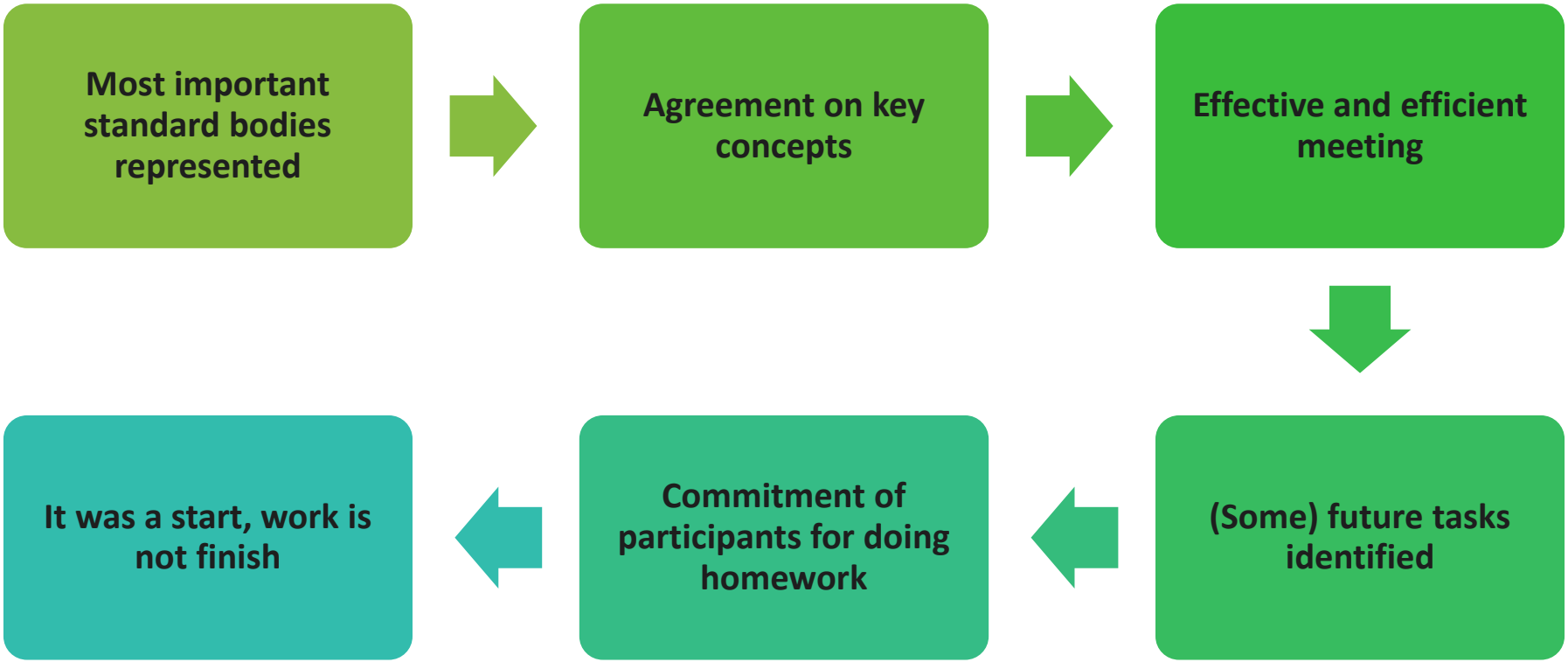
Day 2 – Working Session 3

Commitments

Achema Booth and after works

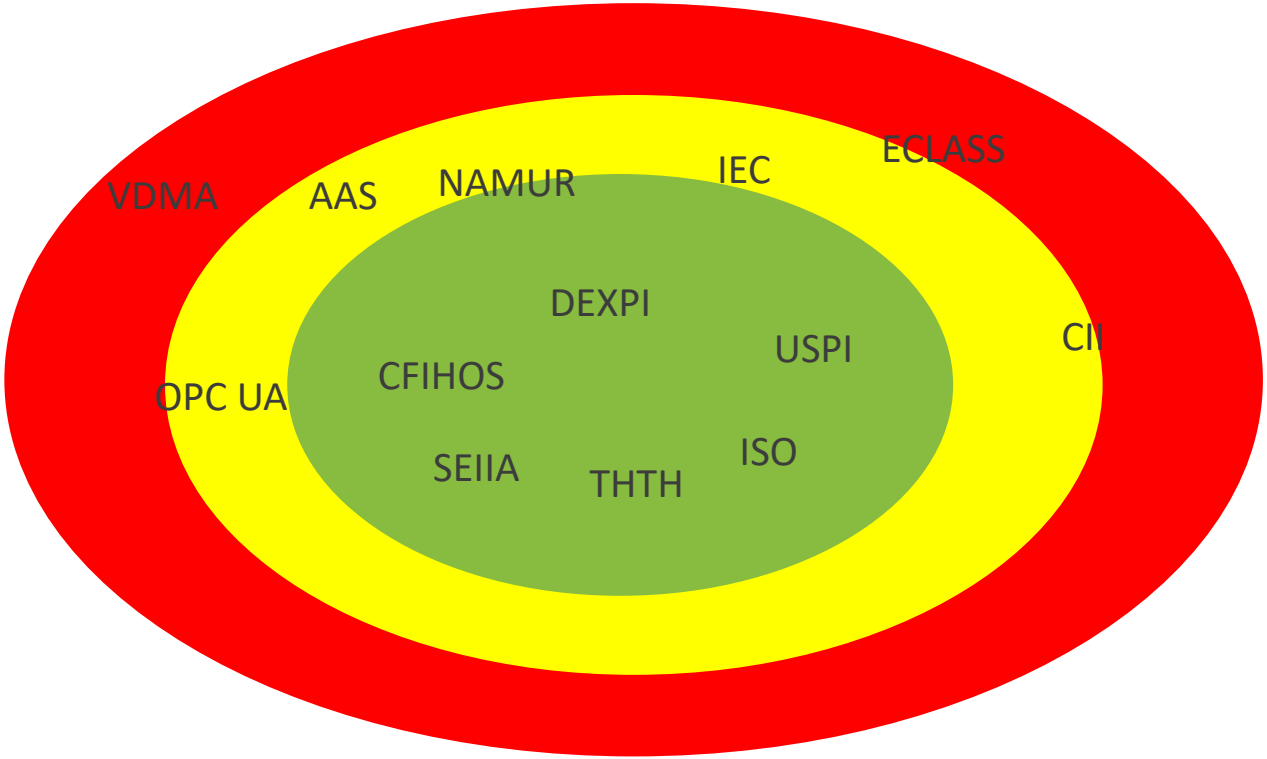
Summary

DEXPI Data Exchange in the Process Industry



Picture of the community

DEXPI Data Exchange in the Process Industry



Activity Definition – DEXPI

DEXPI Data Exchange in the Process Industry

Alignment requirements between organization

DEXPI with
- JIP33 / CFIHOS / ISO15926 part 4 ed. 3 (class definition)
- ISO15926 part 14
- USPI Tagging
- USPI FL3DMS 3D
- I4.0 / AAS
- ECLASS
- VDMA

scope / goal / outcome

- Define DEXPI as the only standard for process and plant structure based on a harmonized asset lifecycle model
- Assure that the information structure of DEXPI is taken into account in the other information models to achieve an “integrated”, data based engineering

Project team/ roles

- Coordination by DEXPI Networking Team / Wilhelm Otten

Challenges / open questions

- Lack of transparency of the different activities
- Parallel developments
- Lack of experts in asset lifecycle data management
- Standards are often drawing based

Activities / Responsible

DEXPI – JIP33 / CFIHOS / ISO15926 part 4 ed. 3	Heiner Temmen, Ida Pe Ingebrigtsen, Onno Paap
▪ Explain DEXPI and check conformity with DEXPI	
▪ CFIHOS RDL working group, MRAIL (ISO 15926)	
DEXPI – ISO 15926 part 14	Heiner Temmen, Gregor Tolksdorf, Johan Klüwer
▪ Explain DEXPI and check conformity with DEXPI	
▪ Part 14 project, MRAIL	
DEXPI – USPI Tagging	Heiner Temmen, Gregor Tolksdorf, Anders Thostrup
▪ Explain DEXPI and check conformity with DEXPI	
▪ USPI project	
DEXPI – USPI FL3DMS	Heiner Temmen, Gregor Tolksdorf Martin te Lintelo
▪ Explain DEXPI and check conformity with DEXPI	
▪ USPI project	
DEXPI – AAS (IDTA working group)	Wilhelm Otten Sten Grüner
▪ Establish DEXPI as plant model in the AAS to use the AAS as exchange medium (use case 1) and as the basis to define Role-AAS / specifications (use case 2)	
DEXPI - ECLASS:	Wilhelm Otten Andre Lindner
▪ Explain DEXPI and check conformity with DEXPI	
▪ Initiate networking	
DEXPI - VDMA:	Wilhelm Otten Andreas Faath
▪ Explain DEXPI and check conformity with DEXPI	
▪ Initiate networking	
DEXPI - BIM:	Reiner Meyer-Rössl, ???
▪ Explain DEXPI and check conformity with DEXPI	
▪ Initiate networking	

Activity Definition – DEXPI+

DEXPI Data Exchange in the Process Industry

Alignment requirements between organization

- ISO 15926 part 4 ed. 3 (activities)
- ISO 15926 part 14
- NAMUR
- I4.0 (submodel)
- ECLASS?
- VDMA?

scope / goal / outcome

- Define DEXPI+ as the only standard for process information model based on a harmonized asset lifecycle model
- Assure that the information structure of DEXPI+ is taken into account in the other information models to achieve an “integrated”, data based engineering

Project team/roles

- Coordination by DEXPI Networking Team / Wilhelm Otten

Challenges / open questions

- Engineering process not harmonized
- Standards are often drawing based
- No common understanding of “process model” and “plant model”

Activities / Milestones (updated)

DEXPI+ - ISO 15926 ▪ Alignment of classes ▪ Additional requirement for classes in ISO 15926	Heiner Temmen, Onno Paap
DEXPI+ - ISO 15926 part 14 ▪ Alignment of the concepts and classes	Heiner Temmen, Johan Klüwer, David Cameron
DEXPI+ - NAMUR (working group 1.1 / 1.3) ▪ Align Automation Engineering requirements with DEXPI+	Wilhelm Otten, Andreas Schüller
DEXPI+ - I4.0/AAS (IDTA working group) ▪ Establish DEXPI+ as a process model (PFD-Representation) in the AAS	Wilhelm Otten, Sten Grüner

Activity Definition – Content Models

DEXPI Data Exchange in the Process Industry

Alignment requirements between organization

- JIP33 – Adrie Postema
- CFIHOS – Peter Townson, Onno Paap, Jason Roberts, Anders Thostrup
- ECLASS – Segments 27, 36 and 37 - Andre Lindner
- IEC (61987 / CDD incl. electrical, …) – Ingo Weber, Klaus Dickmann
- VDMA – Andreas Faath
- ISO15926 part 4 ed. 3 (only classes) – Nils Sandsmark, Onno Paap
- ISO 15926 part 14 – Johan Klüwer
- NAMUR – Andreas Schüller

scope / goal / outcome

- Share knowledge
- Initiate collaborations
- Reduce parallel work and parallel specifications
- Harmonized asset information models

Project team/roles

- Accompanying consultation by Networking Team / Wilhelm Otten

Challenges / open questions

- Lack of transparency of the different activities
- Parallel developments
- Different organizations
- Different technologies

Activities / Responsible

Wilhelm Otten,
Heiner Temmen,
Gregor Tolksdorf

DEXPI and all affected initiatives

- Share knowledge meeting
- Common modelling rules meeting

Alignment work: Apparatus, Machines and Piping

- JIP 33, CFIHOS
- ECLASS 36, 37
- VDMA
- ISO 1926 part 4
- ISO 15926 part 14

Alignment work: Instrumentation

- JIP 33, CFIHOS
- ECLASS 27
- IEC 61987
- VDMA ???
- ISO 1926 part 4
- ISO 15926 part 14
- NAMUR

Alignment work: Electrical

- JIP 33, CFIHOS
- ECLASS 27
- IEC / CDD
- VDMA ???
- ISO 1926 part 4
- ISO 15926 part 14