DEXPI - P&ID Data Exchange

Heiner Temmen
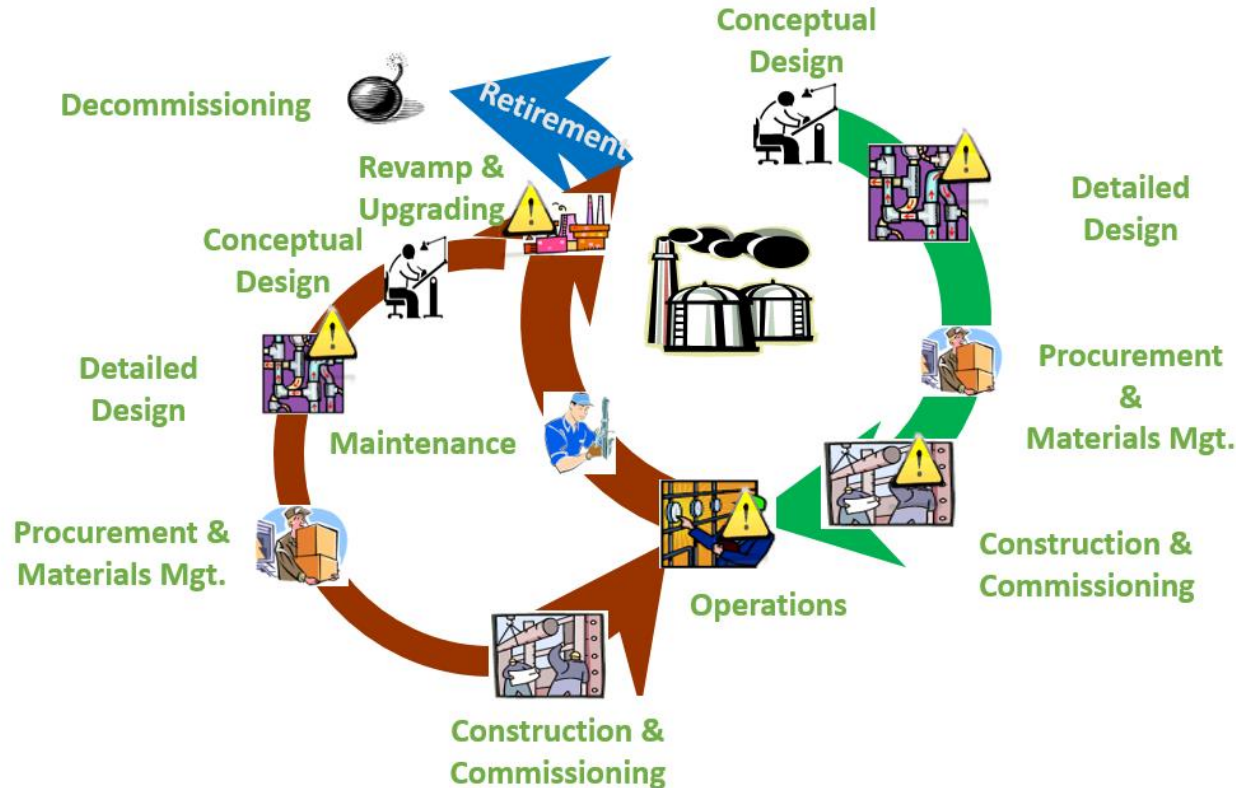
Evonik

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Motivation statement

Data Exchange in Plant Life Cycle

Process Industry

Still typical work method

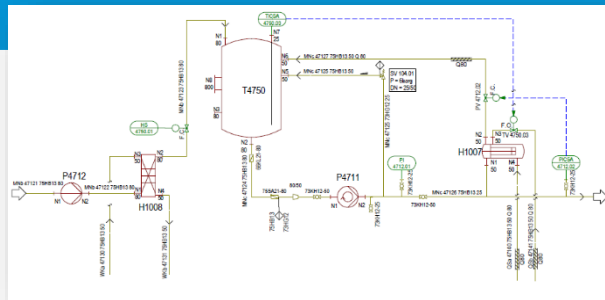**Between stakeholders like organizations or disciplines**

DEXPI group

DEXPI Mission

What we do

We work to create an **open**, neutral and reliable **data exchange standard** for the **process industry** to establish a future-proof **digitalized collaboration.**

... and we started with the P&ID

DEXPI approach

Think global, start with limited scope

Methodology: ISO 15926 + Proteus (XMpLant) scheme
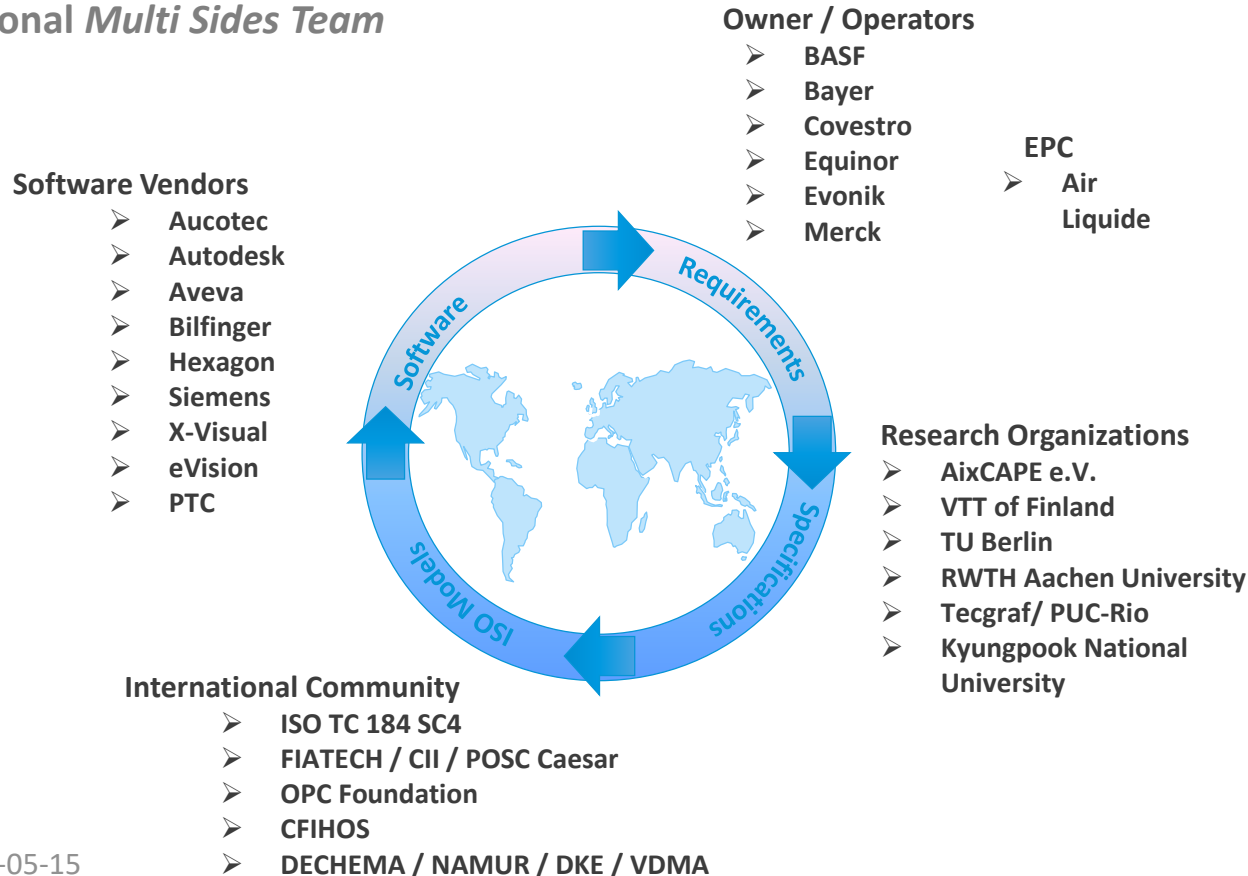
All main CAE software vendors involved

Use existing standards (Do not re-invent the wheel)

Bottom up, pragmatic approach

International coverage, not only local

DEXPI – A Successful Team

DEXPI Data Exchange in the Process Industry

International *Multi Sides Team*

Software Vendors
- Aucotec
- Autodesk
- Aveva
- Bilfinger
- Hexagon
- Siemens
- X-Visual
- eVision
- PTC

Owner / Operators
- BASF
- Bayer
- Covestro
- Equinor
- Evonik
- Merck

EPC
- Air Liquide

Research Organizations
- AixCAPE e.V.
- VTT of Finland
- TU Berlin
- RWTH Aachen University
- Tecgraf/ PUC-Rio
- Kyungpook National University

International Community
- ISO TC 184 SC4
- FIATECH / CII / POSC Caesar
- OPC Foundation
- CFIHOS
- DECHEMA / NAMUR / DKE / VDMA

Software · Requirements · Specifications · ISO Models

DEXPI Organization

Open community

- ➤ DEXPI f2f meetings (6 per yr) Frankfurt

- ➤ DEXPI hackathons (2 per yr)

- ➤ DEXPI marketing and technical web meetings
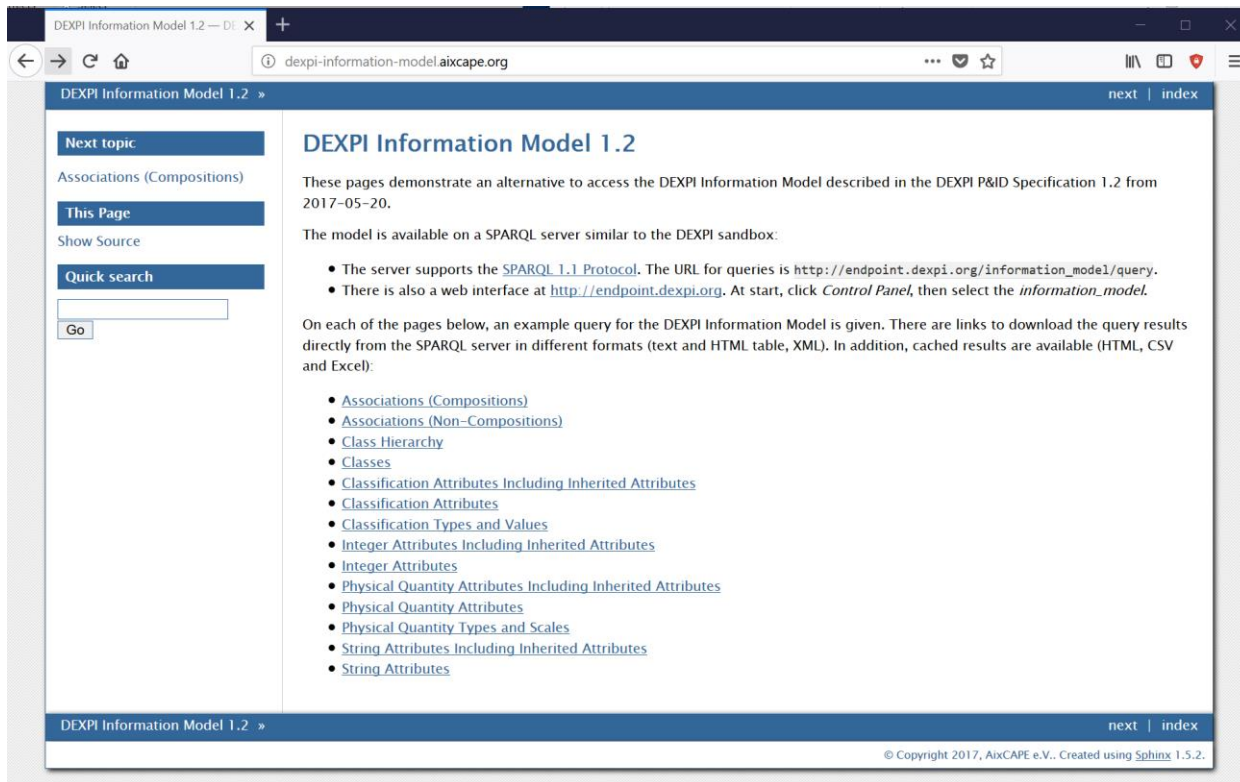
- ➤ DEXPI annual management meeting

DEXPI Data Exchange in the Process Industry

DEXPI Deliverables

Deliverables

public license concept: cc-by-sa

1. DEXPI Specification for Exchange of PIDs (Version 1.2)

2. Extension for the Proteus Schema (resulting in Version 4.0.1)

3. Tools & Test cases

4. CAE Interfaces of the leading PID software

www.DEXPI.org

Face to the community

DEXPI Information Model published

http://dexpi-information-model.aixcape.org/

endpoint.DEXPI.org

SPARQL Endpoint Service

DEXPI ENDPOINT (fuseki)

Server Management

Control Panel

Documentation

Fuseki documentation

Validators
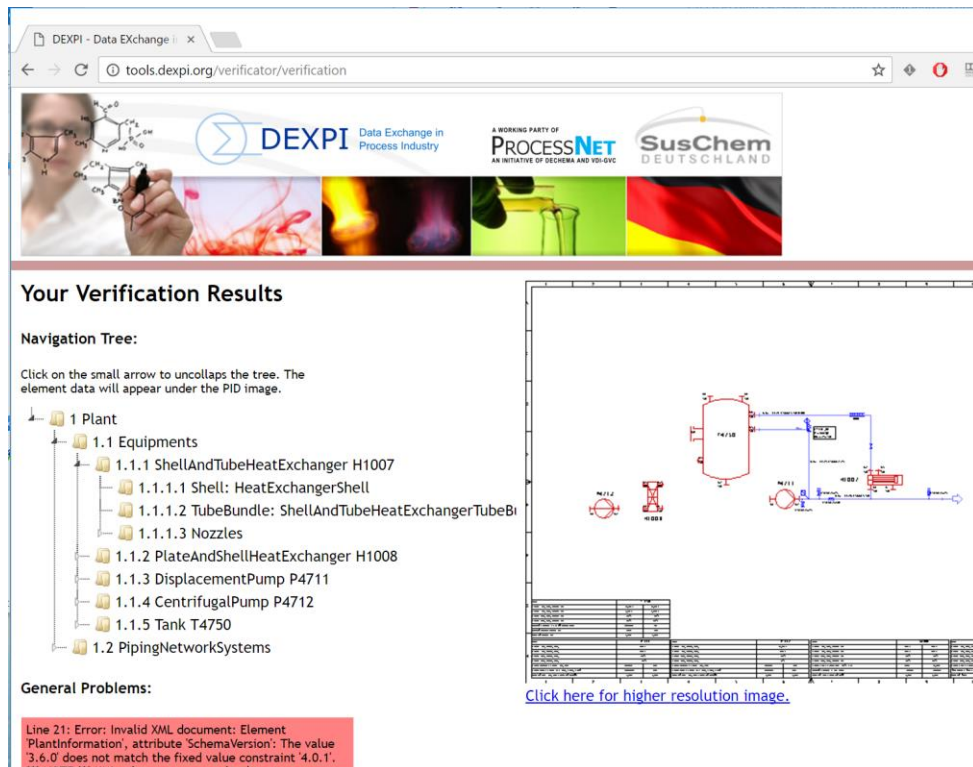
- SPARQL query validator
- SPARQL update validator
- RDF data validator
- IRI validator

Standards

- SPARQL 1.1 Query
- SPARQL 1.1 Update
- SPARQL 1.1 Protocol
- SPARQL 1.1 Uniform HTTP Protocol for Managing RDF Graphs

DEXPI Verificator

As offline versions available

Test Cases

DEXPI Data Exchange in the Process Industry

Free available on https://gitlab.com/dexpi/TrainingTestCases

P Public Training Test Cases
Project ID: 8453791

🔲 Add license   ◦ **320** Commits   ⑂ **9** Branches   ⬭ **0** Tags   ▢ **20.5 MB** Files

📄 C01V01-HEX.EX03-VER.IM01.html	SHAPE LIBRARY AND PLANT STRUCTURE ADD...
🖼 C01V01-HEX.EX03.png	SHAPE LIBRARY AND PLANT STRUCTURE ADD...
📄 C01V01-HEX.EX03.xml	SHAPE LIBRARY AND PLANT STRUCTURE ADD...
📄 C01V01-SAG.EX01.XML	Added SAG V01EX01
📄 C01V01-SAG.EX02.XML	Upload C01V01-SAG.EX02.XML
📄 C01V01-SAG.EX02.pdf	Upload C01V01-SAG.EX02.PDF
📄 C01V01.pptx	Description of the new complete DEXPI P&ID
📄 readme.md	Update readme.md to point to conformance te...

⌂ ⌄   ☆ Star 1   ⑂ Fork 1   Clone ⌄

`stability` `experimental`

DEXPI Interoperability Matrix

Automatically created by DEXPI-Matrix-Crawler version 0.3 Tue Jul 17 19:28:00 CEST 2018

Interoperability Matrix:

__	AUD	AVV	HEX	SAG	VTT	XVT
AUD	0%	0%	0%	1,8%	14,3%	1,8%
AVV	7,1%	0%	0%	5,4%	14,3%	3,6%
HEX	19,6%	0%	0%	10,7%	17,9%	5,4%
SAG	21,4%	1,8%	0%	3,6%	17,9%	1,8%
VTT	0%	0%	0%	0%	0%	0%
XVT	0%	0%	0%	0%	0%	0%

DEXPI interfaces of software systems

CAE and smart applications

CAE Vendor		Product	DEXPI Interface
Autodesk	AUTODESK	AutoCAD P&ID 2019	Import & Export
Aucotec	AUCOTEC	Engineering Base	Export
Aveva	AVEVA CONTINUAL PROGRESSION	Aveva PID	Import & Export
Bilfinger	BiLFINGER	PIDGraph	Export
Hexagon	HEXAGON	SmartPlant PID	Export
PCT	ptc	ThingWorx	Import
Siemens	SIEMENS	Comos PID	Import & Export
VTT	VTT	Apros	Import
X-Visual	VISUAL	PID	Import

DEXPI Technical Design Principles

DEXPI and the ENPRO Lifecycle

The asset lifecycle is separated into four aspects with three underlying data structures

Functional Requirements	Functional Design	Asset Specification	Asset in Operation
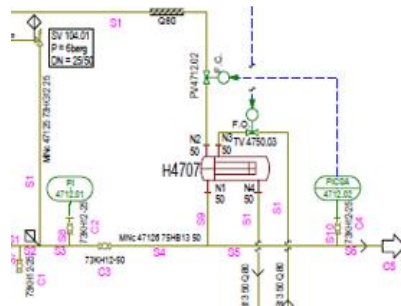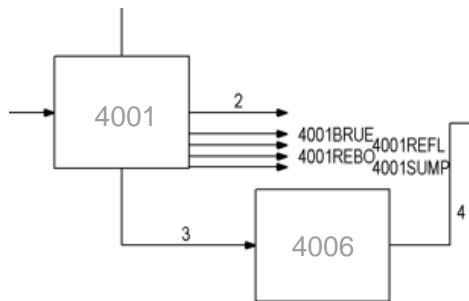
Process Structure	Plant Structure		Asset Structure

Design Principles

The DEXPI activities are driven by several basic development guidelines

Openness and transparency of the data model, test cases and communication

Usage of international accepted standards

Relation to different life cycle aspects

Digitalization = step from Documents to Data

Separation between engineering content and graphics

use of UML concepts like specialization and decomposition for the modelling of engineering and plant objects

P&ID main components

Data, graphics and topology

Piping

Instrumentation

Apparatus & Machines (EQP)

Symbols

Labels

Engineering content

Off Page Connectors

Annotations

Title Block
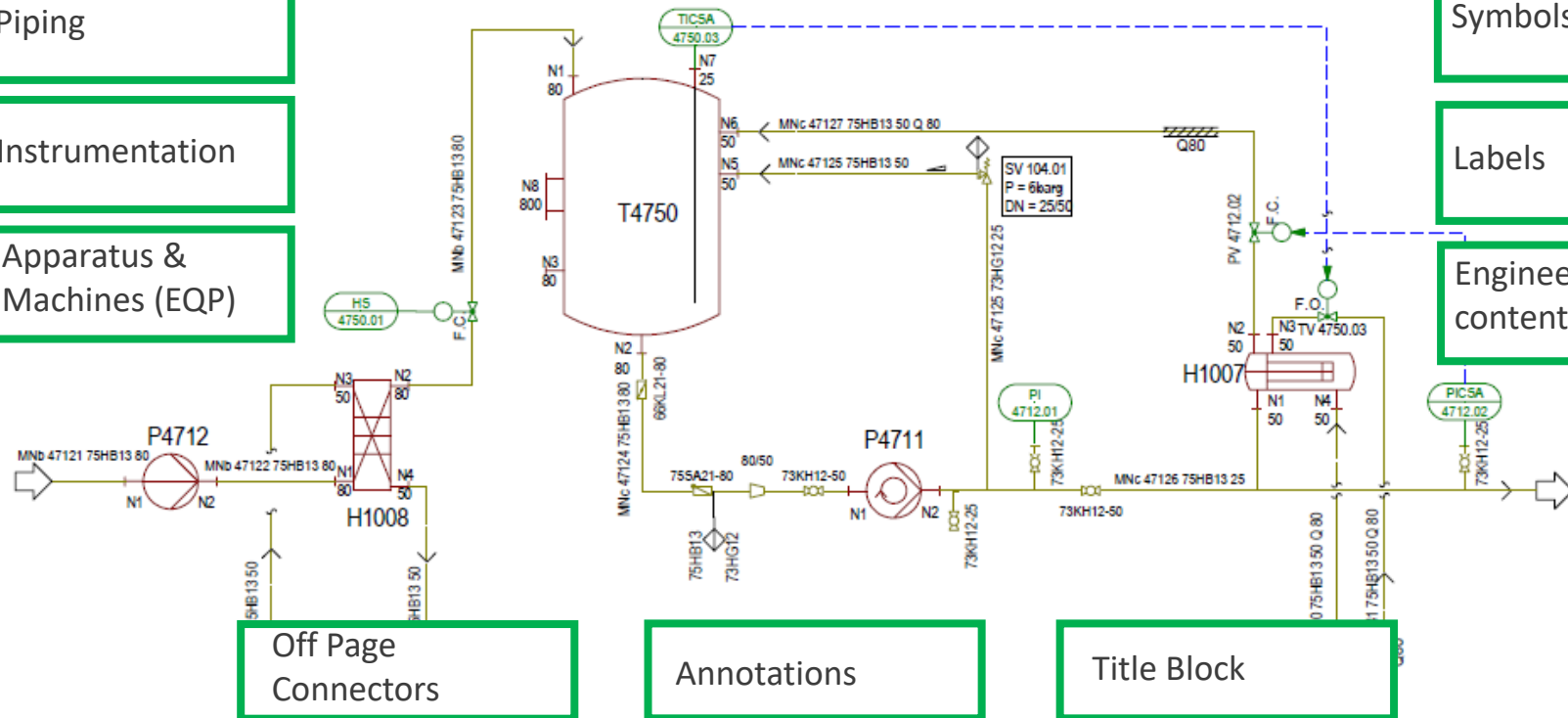
International Standards

ISO and IEC

➢ **DEXPI specification based on international standards**

➢ **Applicable for IEC, ISA and DIN based P&IDs**

Plant Structure	Apparatus / Machines	Piping components	Instrumentation	Communication
ISO 10209	ISO 10628	ISO 10628	IEC 62424	ISO 15926
			IEC 61987	Proteus 4.0.1 (formerly XMPlant)

Plant Breakdown Structure

Based on ISO 10209

Elements of the identification system for a process plant						
ISO 10209:2012		**ISA 95**	**DIN 28000-3**		**DEXPI**	
en	de		en	de	major	additional
		Enterprise			Enterprise	
works	Werk	Site	Site	Standort	Site	
		Area				Area
industrial complex	Anlagenkomplex		Industrial Complex	Anlagenkomplex, Betrieb	Industrial Complex	
process plant	verfahrenstechnische Anlage	Process Cell	Process Plant/Plant Unit	Verfahrenstechnische Anlage	Process Plant	
plant	Anlage					
plant section	Teilanlage	Unit	Subprocess/Plant Component	Teilanlage	Plant Section	
Equipment	Anlagenteil		Technical Item	Technische Einrichtung	Plant Item	

Equipment Taxonomy

Based on ISO 10628 and ISO 14224

Piping Taxonomy

DEXPI Data Exchange in the Process Industry

Based on ISO 10628
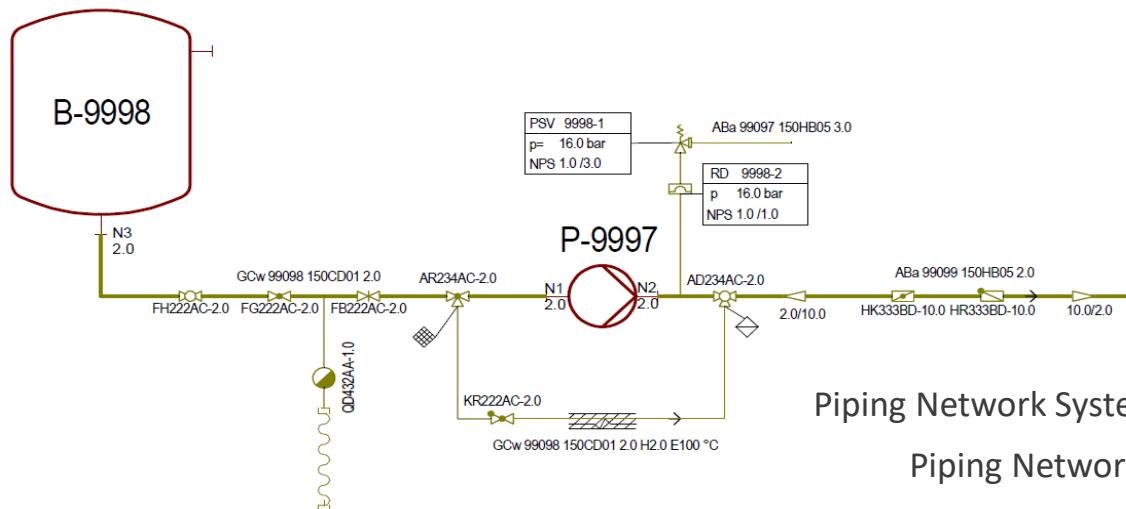
Piping Network System

Piping Network Segment

Piping Components (ISO 10628:2012)

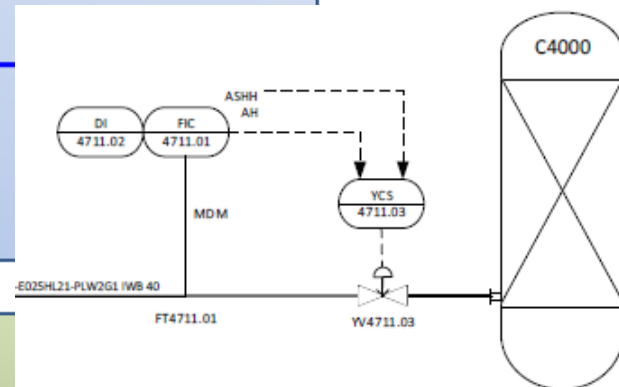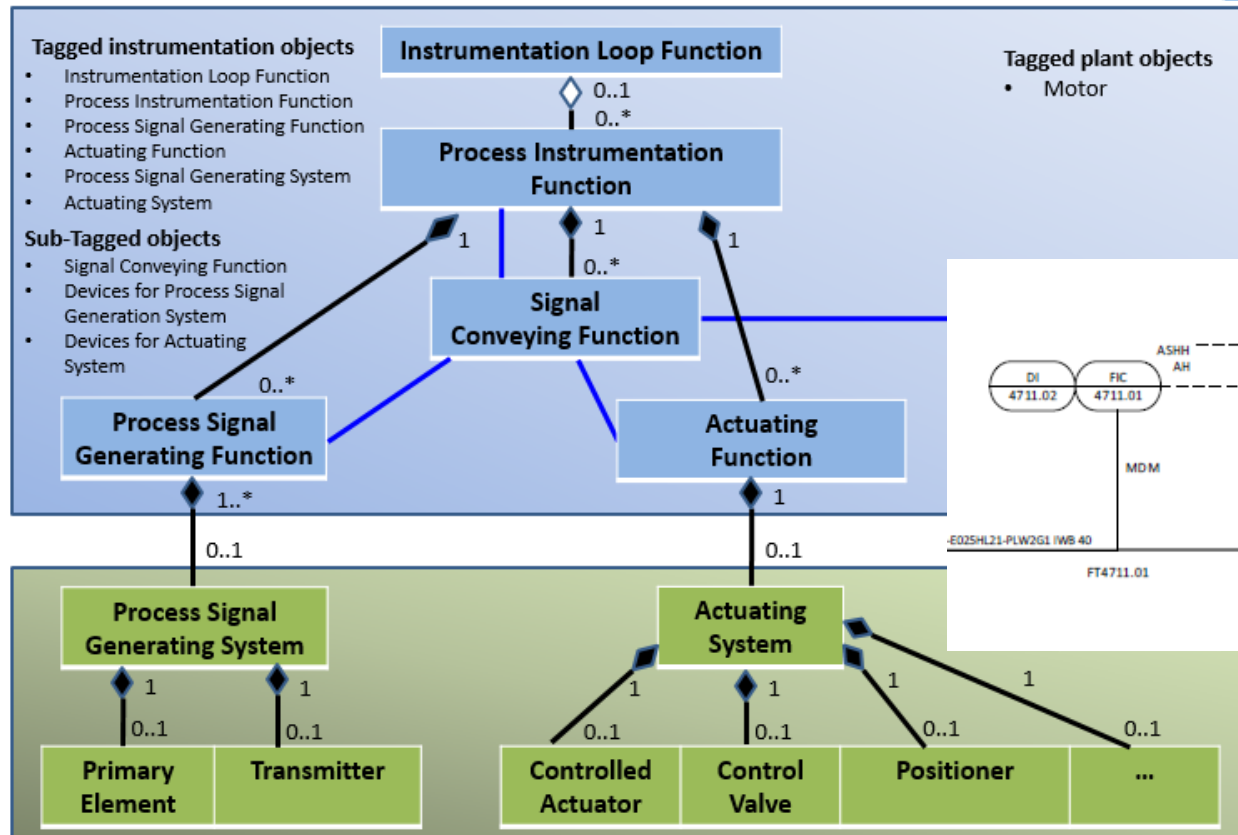| 21	Valves
22	Check valves
23	Valves and fittings with safety function
24	Fittings

Class referencing

Use of ISO 15926 industry sandboxes

EQP Type	EQP Sub Type	RDL Class
VESSEL		http://data.posccaesar.org/rdl/RDS414674
	PRESSURE VESSEL	http://data.posccaesar.org/rdl/RDS427229
	TANK	http://data.posccaesar.org/rdl/RDS445139
	SILO	http://data.posccaesar.org/rdl/RDS1022399
	SPECIAL VESSEL	http://sandbox.dexpi.org/rdl/data/SpecialVessel
HEAT EXCHANGER		http://data.posccaesar.org/rdl/RDS304199
	SHELL AND TUBE HEAT EXCHANGER	http://data.posccaesar.org/rdl/RDS419084
	PLATE AND SHELL HEAT EXCHANGER	http://data.posccaesar.org/rdl/RDS441719
	SpiralHeatExchanger	http://sandbox.dexpi.org/rdl/data/SpiralHeatExchanger
	ELECTRIC HEATER	http://data.posccaesar.org/rdl/RDS14070475
	AIR COOLING SYSTEM	http://data.posccaesar.org/rdl/RDS277379
	ThinFilmEvaporator	http://sandbox.dexpi.org/rdl/data/ThinFilmEvaporator

Instrumentation

DEXPI — Data Exchange in the Process Industry
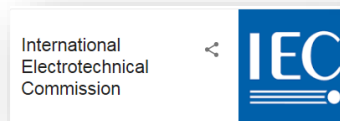
based on:
IEC 62424

based on:
IEC 61987

DEXPI Collaboration

DEXPI's Influence and cooperation

Other big player

DEXPI & CFIHOS
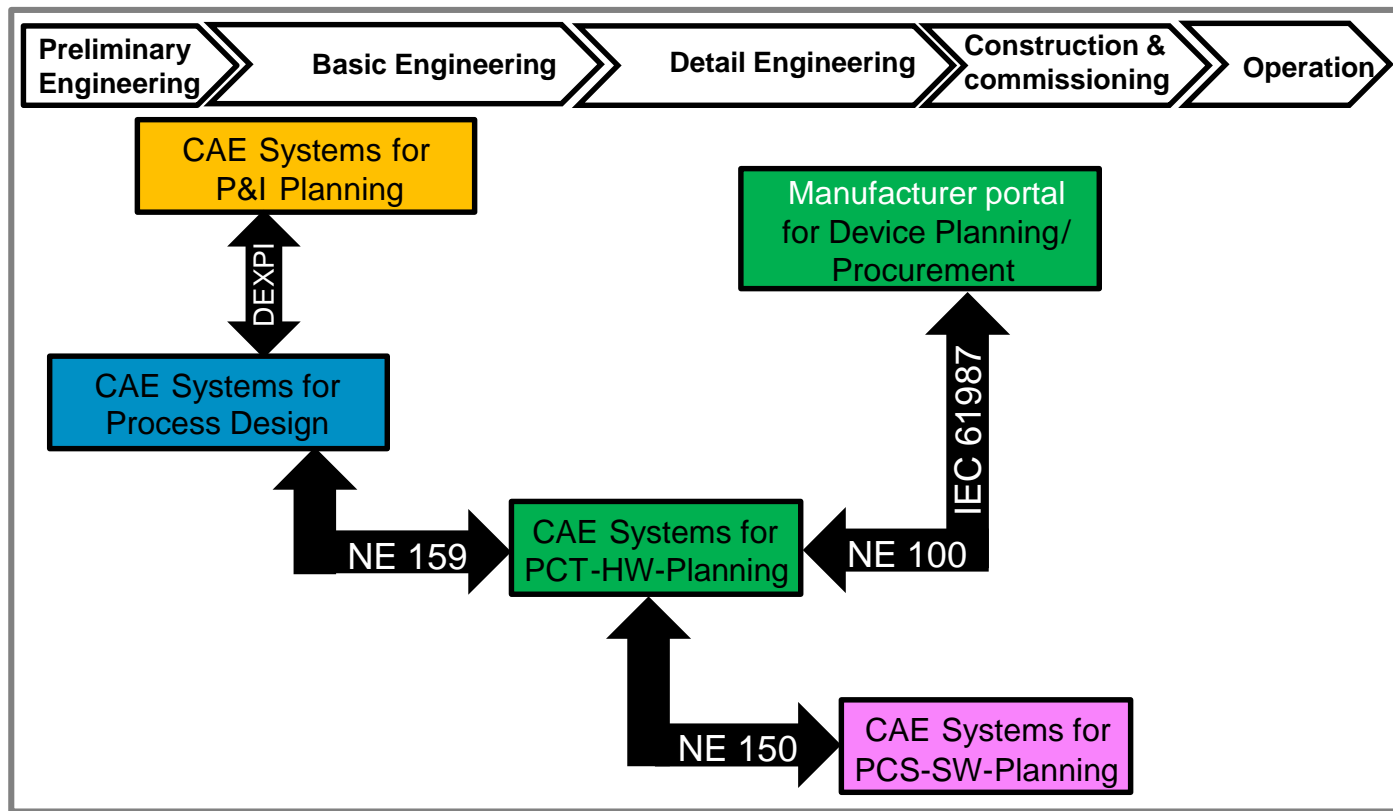

Working closer together: MoU signed and content alignment takes place
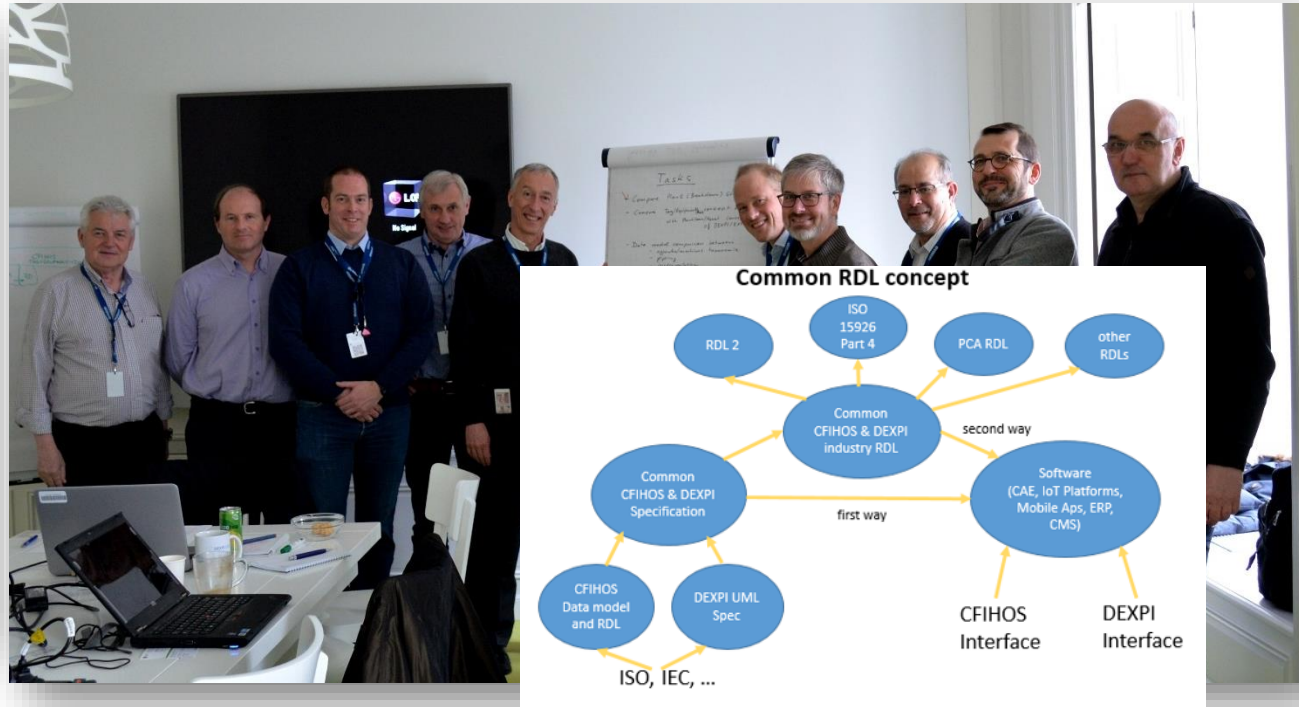
NAMUR and DEXPI

Instrumentation data models aligned with DEXPI

NAMUR and DEXPI

Outlook: Instrumentation – international standardization

Next steps

Next steps

DEXPI into the daily business

- ➢ use in capital projects
  - ➢ P&ID exchange
  - ➢ Interface to other disciplines like cost estimation, instrumentation, 3D, …
  - ➢ Handover together with CFIHOS
  - ➢ Generation of the Plant Maintenance structure
  - ➢ smart construction and maintenance support
  - ➢ Data analysis by use of OPC UA adapter – predictive maintenance
  - ➢ …
- ➢ DEXPI product management: operation, maintenance and extensions
- ➢ future cooperation with CFIHOS, NAMUR, OPC UA, …
- ➢ more global presence