



ISO 15926 in Action

Production Grade Exchange of P&ID Drawings



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Key learning objectives

At the end of this class, you will be able to:

- Understand Autodesk iRING/ISO15926 strategy and implementation
- Understand the needs of an owner/operator of a process plant in regards to data exchange
- Learn about the challenges of data-exchange implementation and discover their Solutions
- Understand the benefits of a close partnership between industry and Autodesk

Agenda

Challenges – Why Data Exchange

DEXPI group

ISO 15926 – What's that?

Data interchange – Current efforts

Data Interchange – Future plans

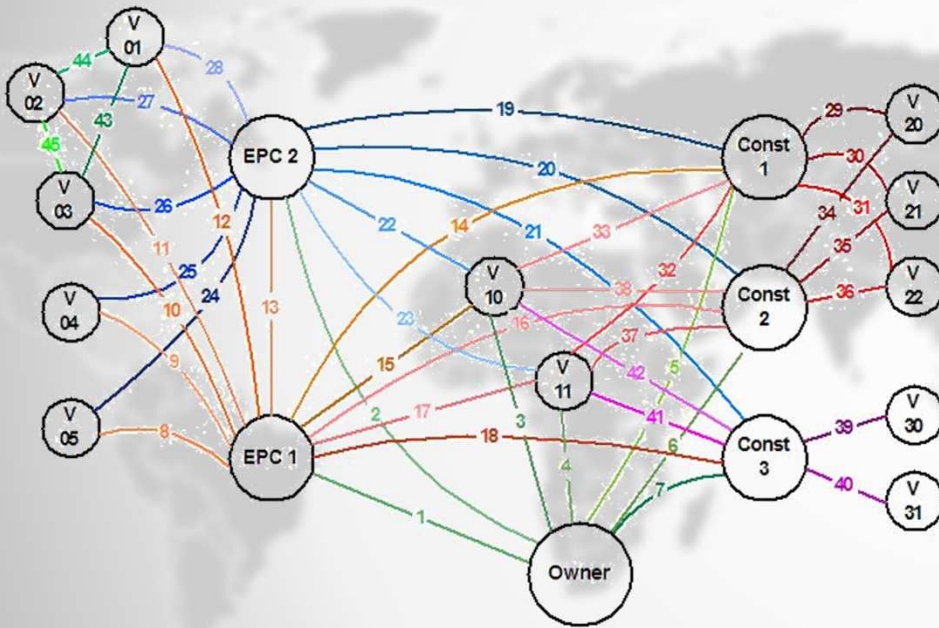
Summary and Q&A



Process Plant Design Projects

Complex and global with constant data exchange

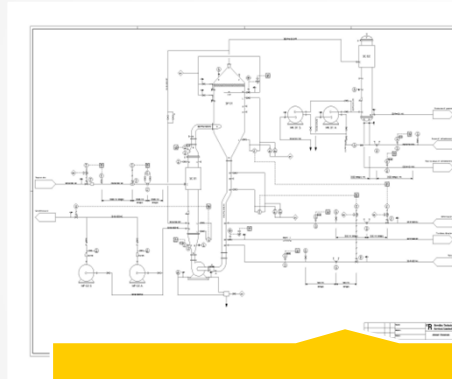
- Multiple interfaces and communication paths
- Multiple languages and communication barriers



Types of data



Documents



Graphics (2D, 3D)

Stückliste zur Schubflange Zeichnung Nr. ...

Zeichen	Gegenstand	Stückzahl	Material	Bemerkungen
A	Schubflange	1	Siemens-Martin-Stahl	Im Gabelende Keilnut.
B	Verchlussstück	1		
C	Bolzen	2	Schmiedeeisen	Mit 3/4"-Gewinde und je zwei Muttern
D	Lagerfächelhälfte	2	Bronze	O und N nebst Sicherung M.
E	Zwischenlagen	2	Melting	Neues Modell, ausgeüben mit Lagermetall.
F	Kreuzkopfbolzen	1	Stahl	Mit 3/4"-Gewinde und Keilnut.
G	Scheibe	1	Schmiedeeisen	
H	Mutter	1		3/4"-Gewinde.
J	Keil	1	Stahl	
K	Scheibe	1	Schmiedeeisen	
L	Kopfschrauben	4		5/16"-Gewinde.
M	Sicherungsschraube	2	Stahl	
N	Mutter	2	Schmiedeeisen	S. a. C
O				
P				

Lists



Structures

Media



Paper



Data media
(CDRW, USB)



FTP



E-Mail



Cloudstorage



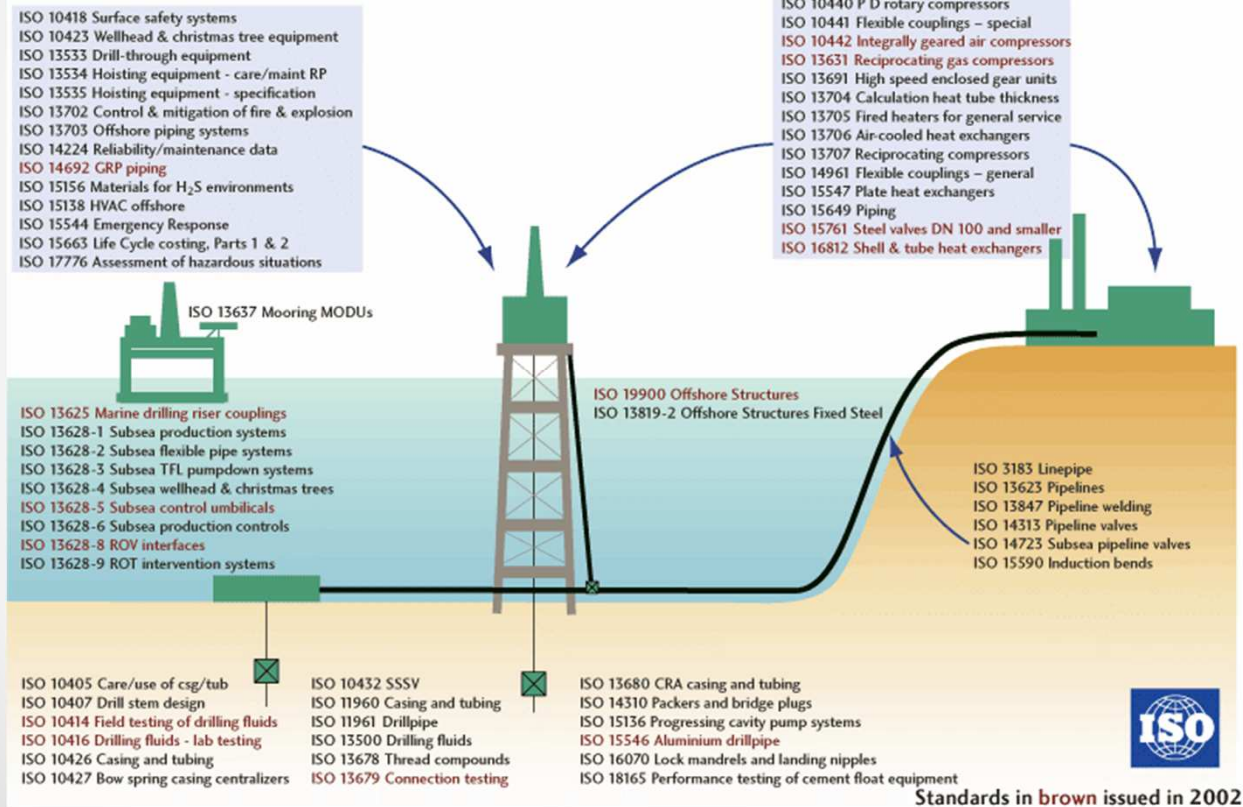
Social Networks



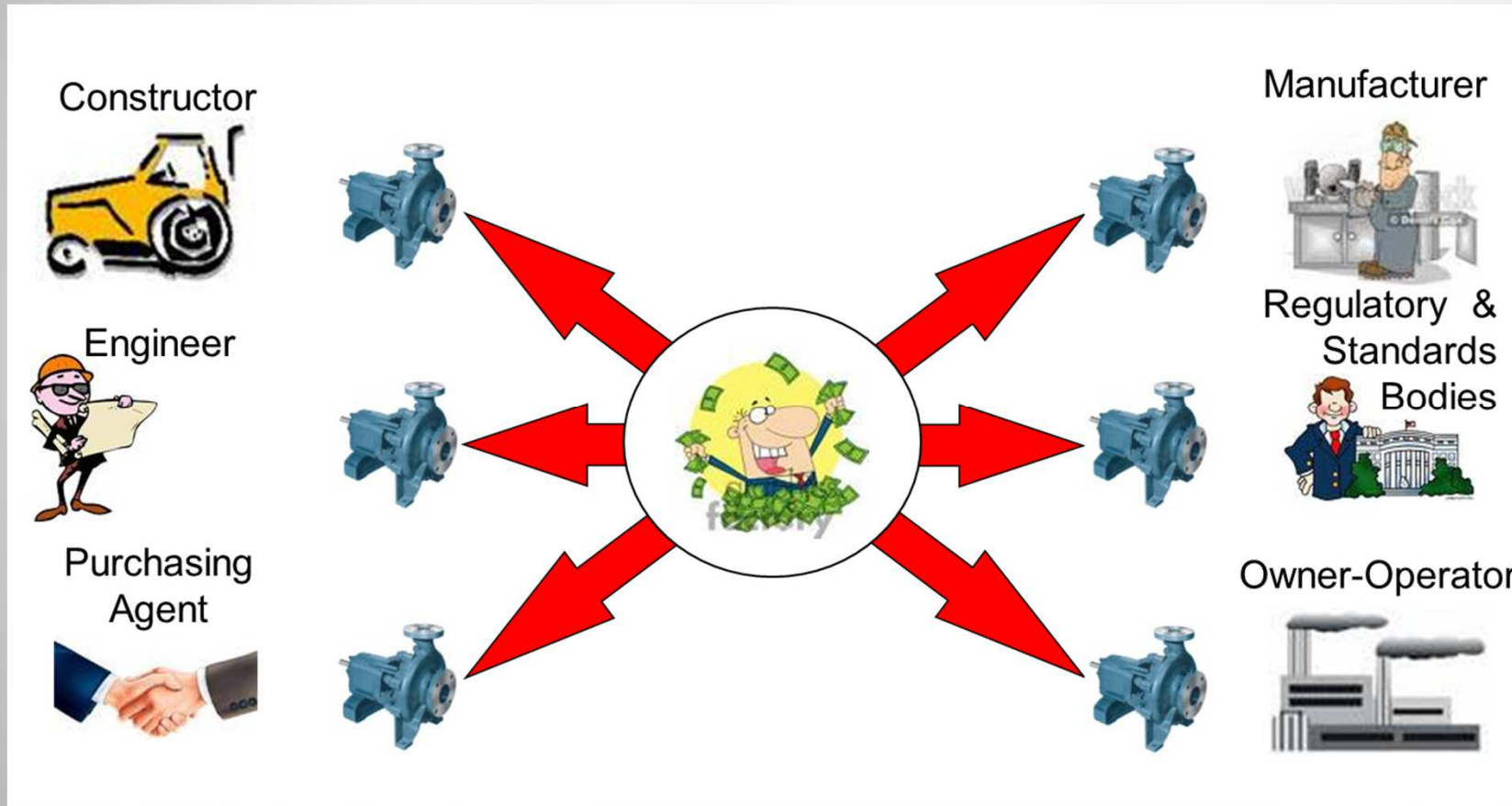
VPN

Data standards in O&G Process Plant

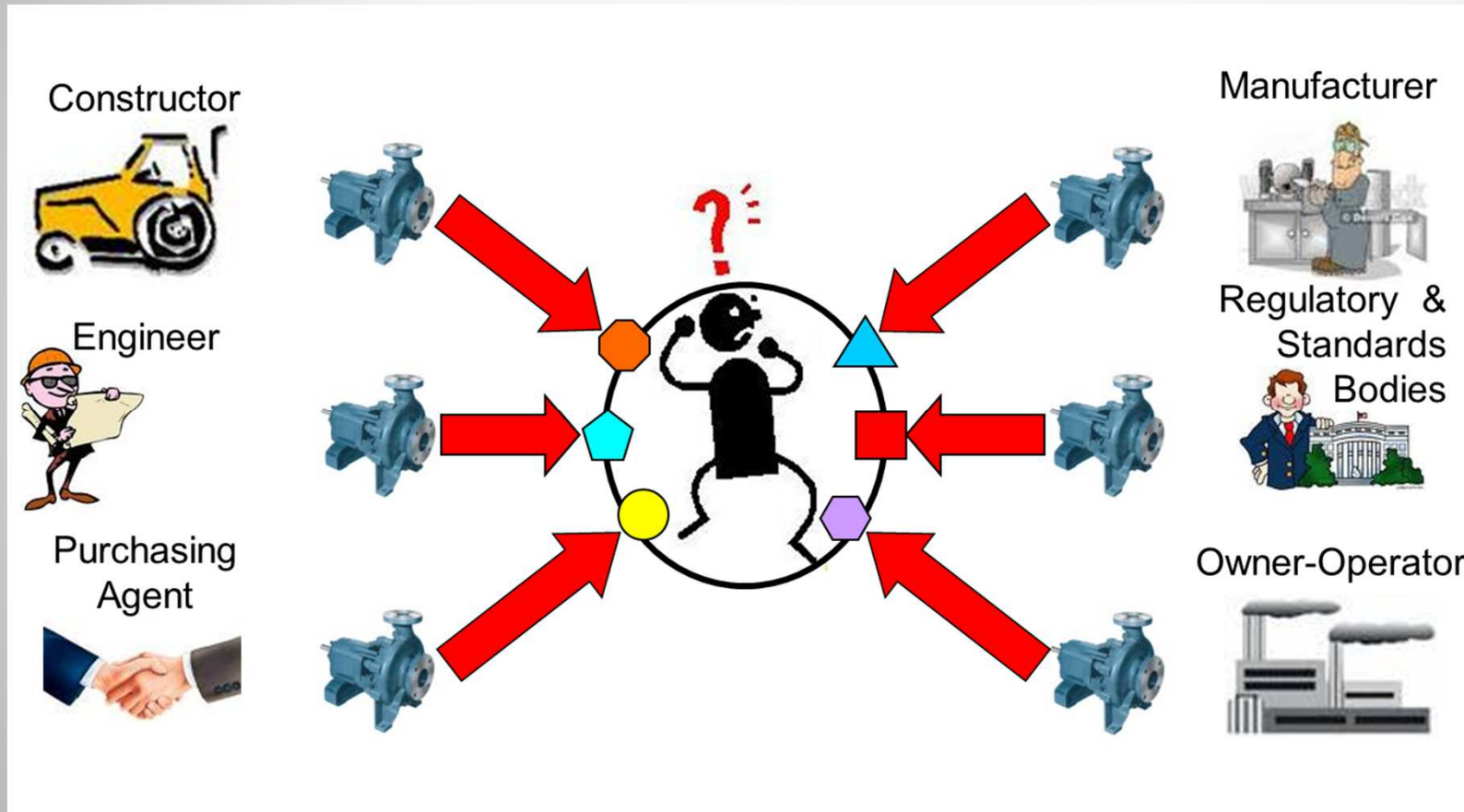
ISO/TC67 standards published



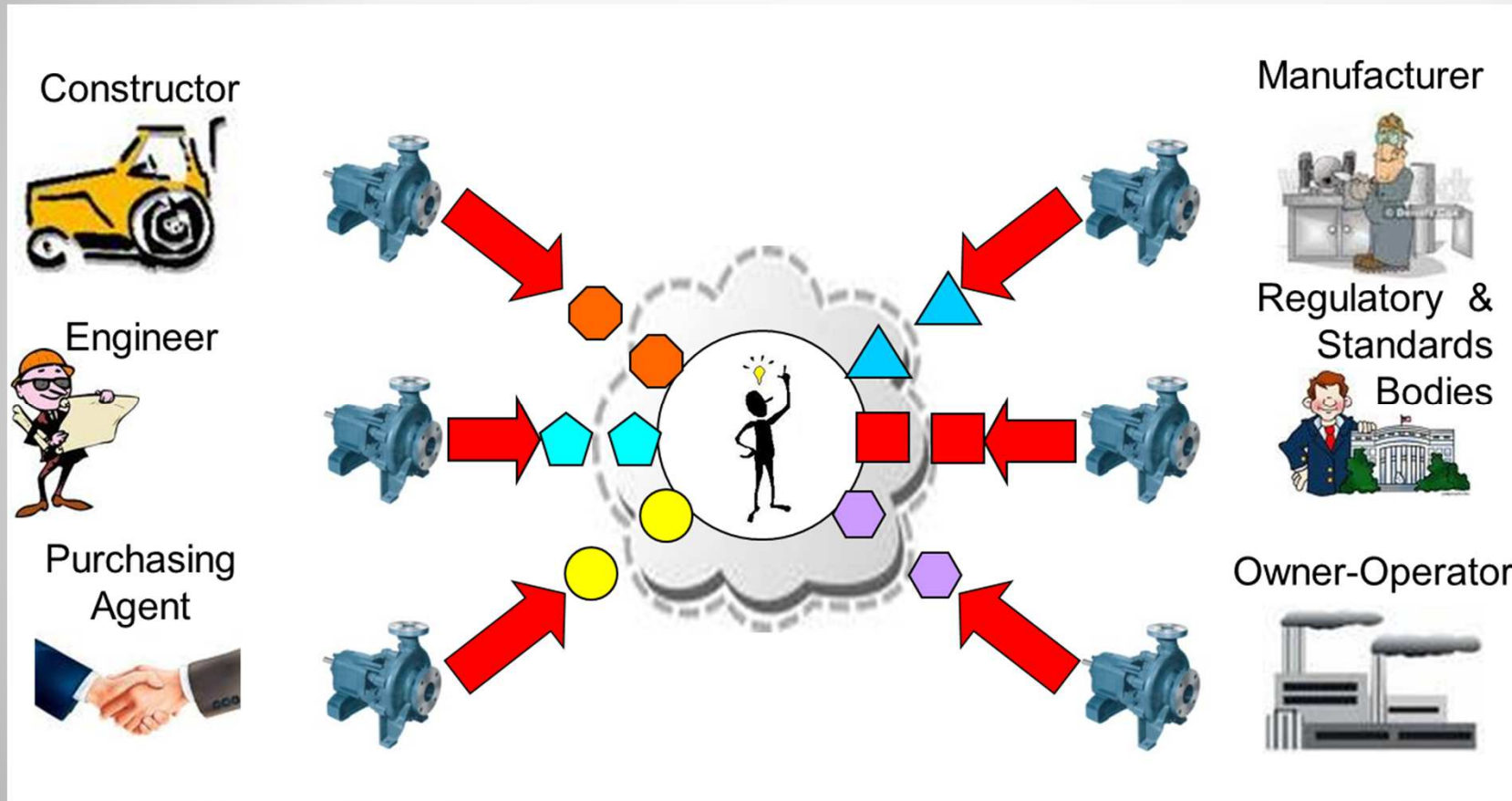
How Information Exchange is Supposed to Work



How Information Exchange Actually Works



How ISO 15926 Handles Information Exchanges



Agenda

Challenges – Why Data Exchange

DEXPI group

ISO 15926 – What's that?

Data interchange – Current efforts

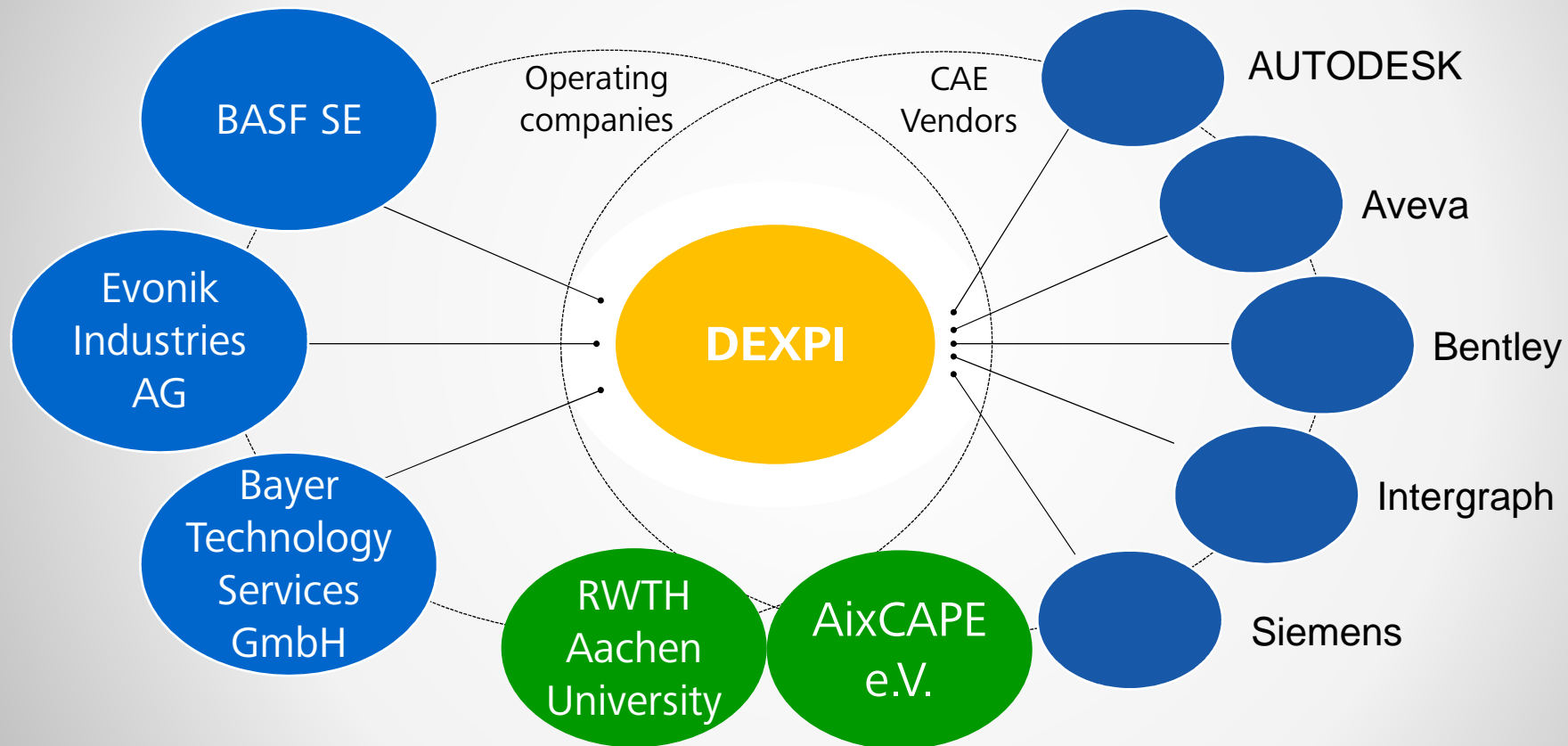
Data Interchange – Future plans

Summary and Q&A



DEXPI members

Data EXchange in the Process Industry



DEXPI approach

- Bottom up
- Small and pragmatic steps
- 80% functionality is fine
- Working and learning group
- Public presentation of results
- Linked to other groups and organisations



DEXPI proof of concept ISO 15926

PAAT Congress, Fulda, Germany 2011



DEXPI proof of concept ISO 15926 PAAT Congress, Fulda, Germany 2011



Some equipment properties as
ISO 15926 OWL format



Process Pressure	NUMERIC	pressure abs
Process Temperature	NUMERIC	temperature
Design Pressure, Max	NUMERIC	pressure gauge
Design Pressure	NUMERIC	pressure gauge
Design Temp	NUMERIC	temperature
Design Temp	NUMERIC	temperature
Heating / Cooling	boolean	boolean
Operating	boolean	boolean
Operating	boolean	boolean

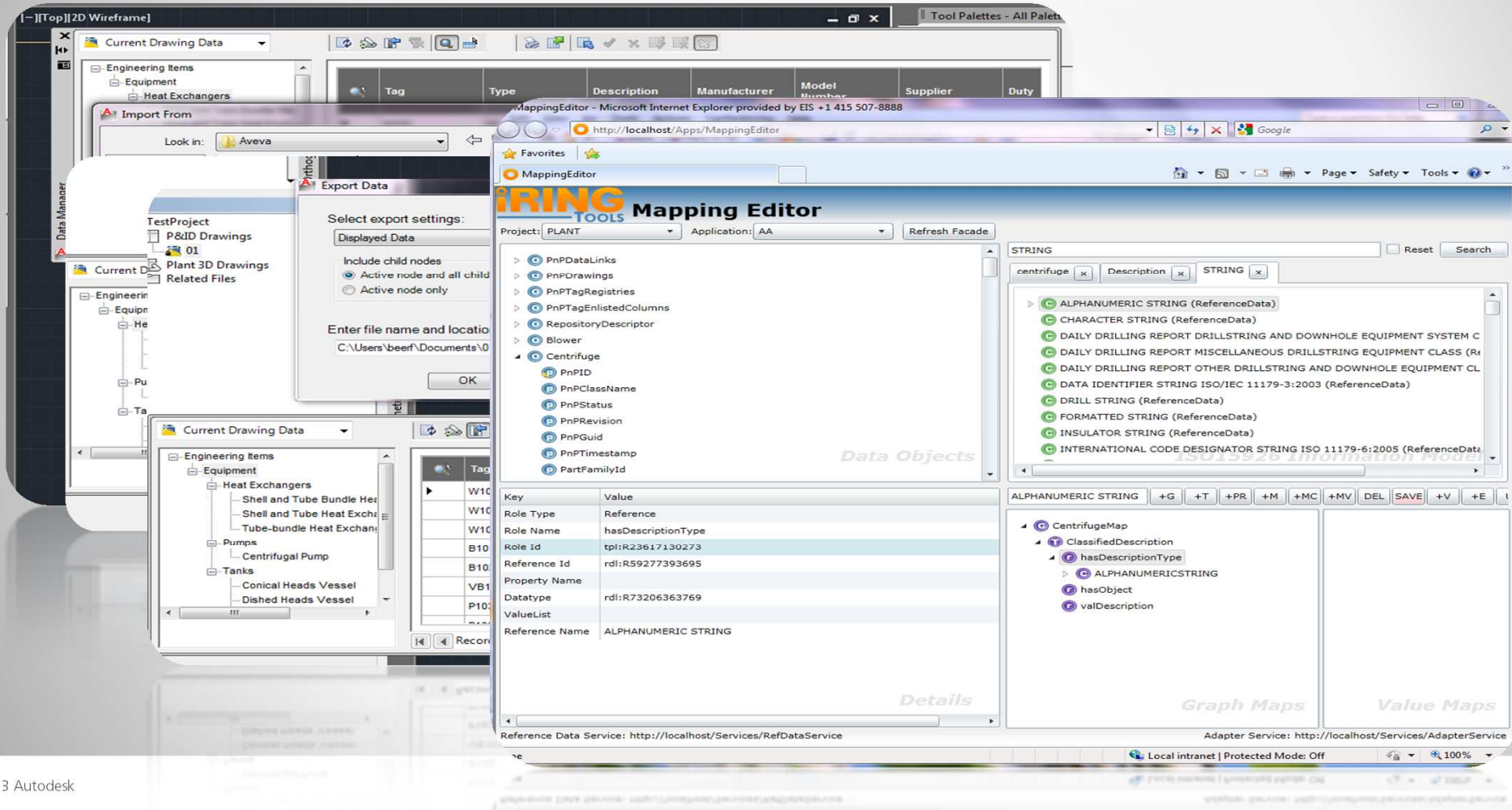
OK!

Autodesk

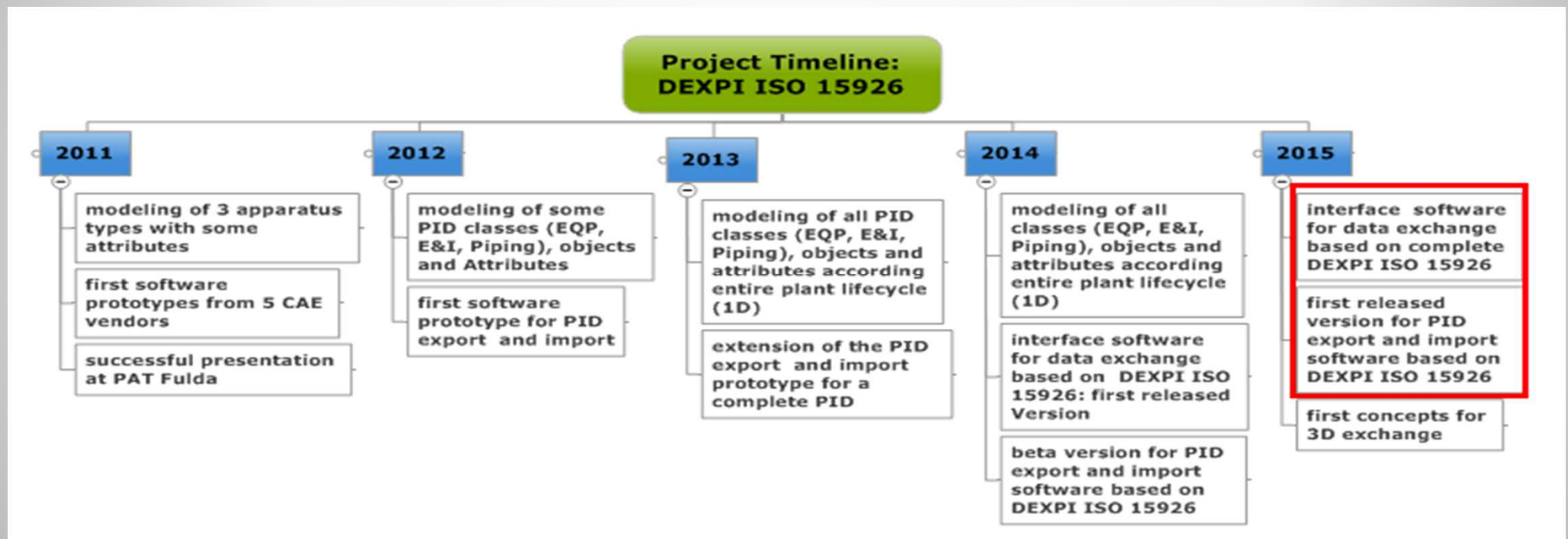
SIEMENS



AutoCAD P&ID ISO 15926 prototype

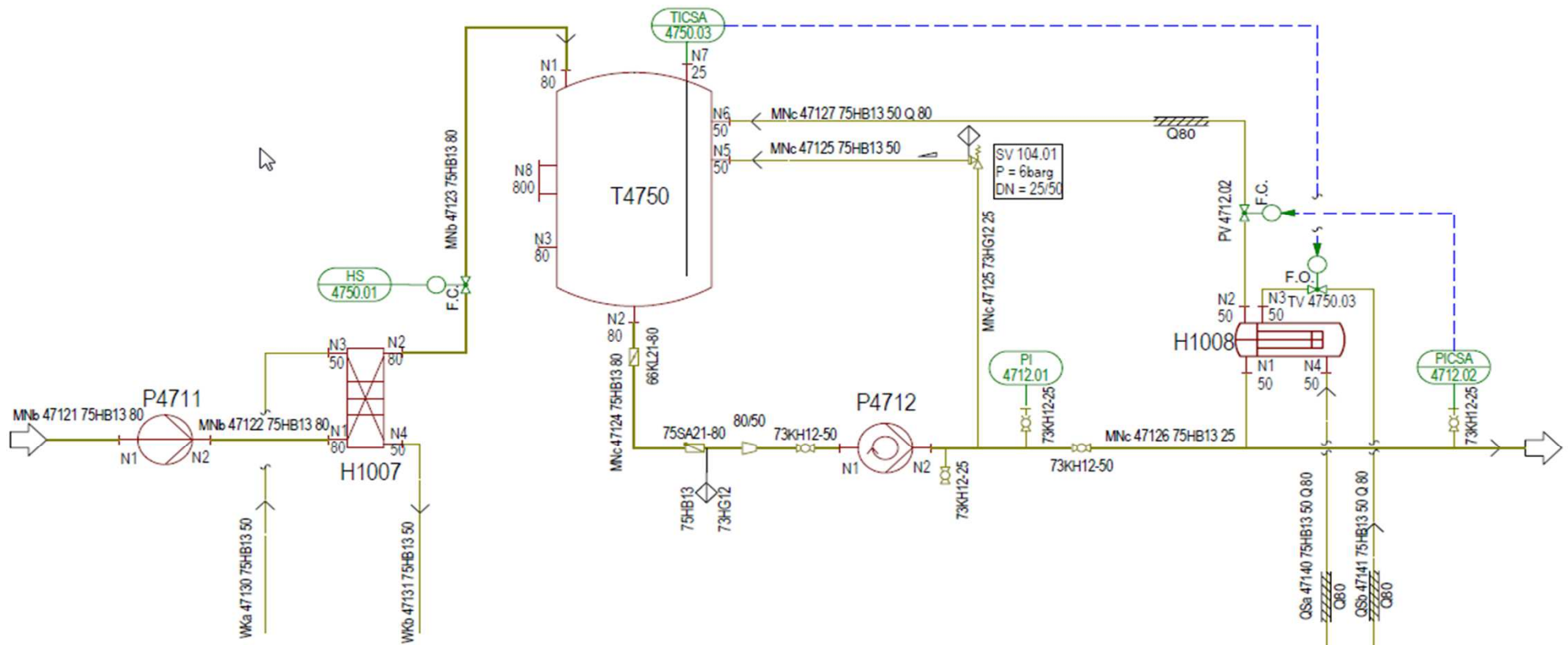


DEXPI roadmap until 2015



main goals

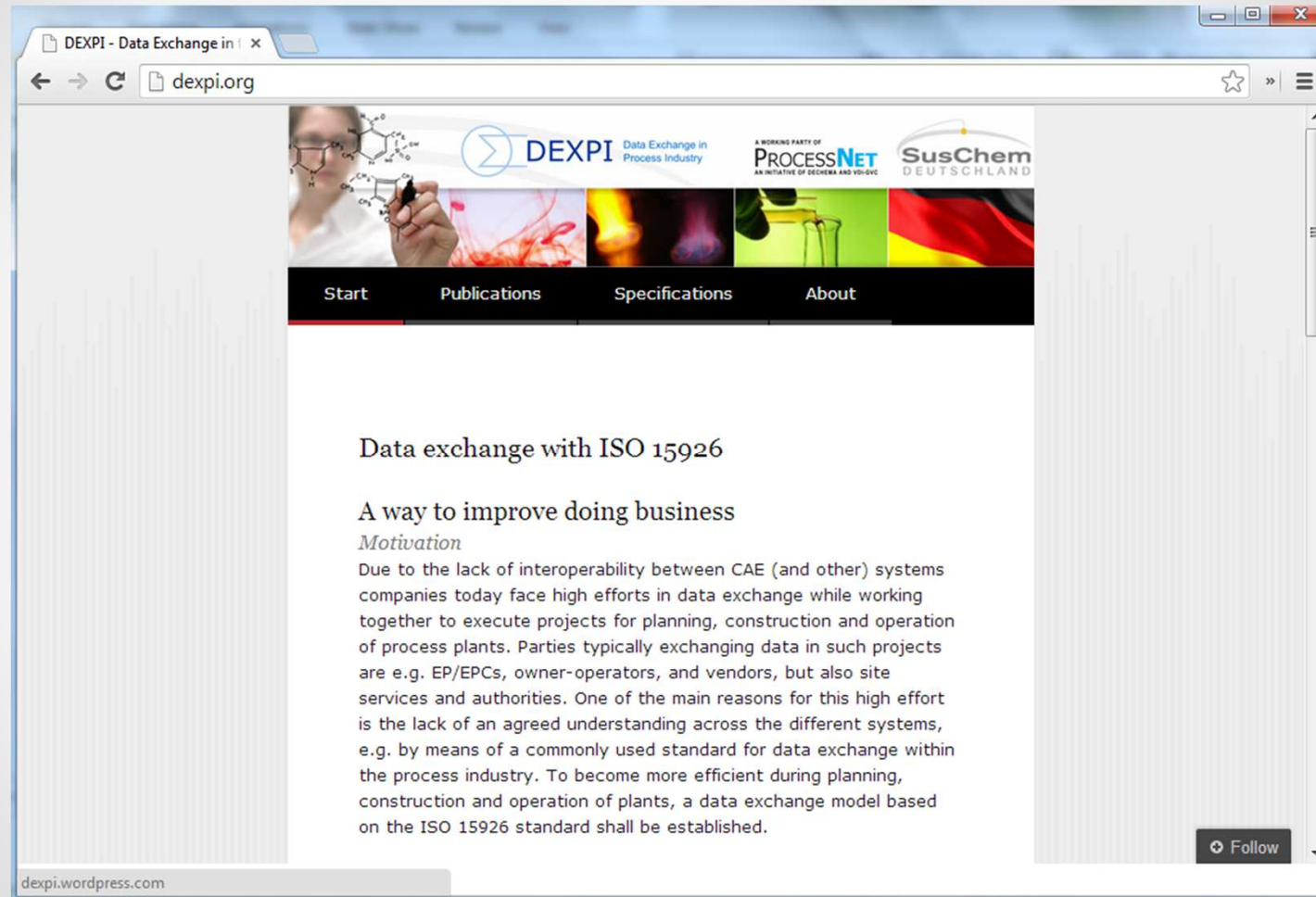
Scope for data exchange - P&ID fragment



Proteus / XMpLant schema to bridge the gap



Website DEXPI.org



Proteus XMpLant V3.3.3

- Several predefined attributes

```
<NominalDiameter Value="80.0" Units="mm" />
```

- Non-predefined attributes as „generic attributes“:

```
<GenericAttribute  
Name="FunctionalObjectDescriptionAssignmentClass"  
Value="Prozessgaskühler"  
Format="string"  
URI="http://posccaesar.org/rdl/RDS2101566251"/>  
  
<GenericAttribute  
Name="DesignHeatFlowRate"  
Value="313"  
Format="double"  
Units="Kilowatt"  
URI="http://sandbox.dexpi.org/rdl/DesignHeatFlowRate"/>
```




DEXPI Validator

Firefox

DEXPI - Data EXchange in the Process In... +

tools.dexpi.org/validator/

Google



DEXPI - Data EXchange in the Process Industry

Validator Prototype

DEXPI Version: 0.6

XMpLant Input File:

Output: Validation Report

For more information see: www.dexpi.org



Formatted Report

Firefox

http://tools.dexpi.org/validator/

tools.dexpi.org/validator/

Validation Report

File	/tmp/validator/session_20130306153837687/upload
Originating System	Autodesk AutoCAD P&ID
Date	2013-03-04 11:59:44
Dexpi Model Version	0.6
Validation Date	2013-03-06 15:38:38
Validity	VALID

Validation Results

Equipments		
Equipment	Validity	Reason
Tank	VALID	
DisplacementPump	VALID	
PlateAndShellHeatExchanger	VALID	
Vessel	ABSENT	Equipment not defined;
DisplacementPump	VALID	
PlateAndShellHeatExchanger	INVALID	
Tank	VALID	
ShellAndTubeHeatExchanger	VALID	
CentrifugalPump	VALID	

Tank

SubEquip	Attribute
-	TheNamePrefixAssignmentClass
-	TheNameSequenceNumberAssignmentClass
-	TheNameSuffixAssignmentClass
-	FunctionalObjectDescriptionAssignmentClass
-	NominalDiameter
-	CylinderLength
Chamber	-
-	SubequipmentIdAssignmentClass
-	UpperLimitDesignPressure
-	LowerLimitDesignPressure
-	UpperLimitDesignTemperature
-	LowerLimitDesignTemperature
-	NominalCapacityVolume
-	MaterialOfConstructionCodeAssignmentClass
Chamber	-
-	SubequipmentIdAssignmentClass
-	UpperLimitDesignPressure
-	LowerLimitDesignPressure
-	UpperLimitDesignTemperature
-	LowerLimitDesignTemperature

Firefox

http://tools.dexpi.org/validator/

tools.dexpi.org/validator/#N65948

Validation Report

File	/tmp/validator/session_201303061538556/uploaded_file.xml
Originating System	Autodesk AutoCAD P&ID
Date	2013-02-27 20:31:39
Dexpi Model Version	0.6
Validation Date	2013-03-06 15:35:55
Validity	INVALID

Validation Results

Equipments		
Equipment	Validity	Reason
HeatExchanger	ABSENT	Equipment not defined;
CentrifugalPump	VALID	
Vessel	ABSENT	Equipment not defined;
DisplacementPump	VALID	
PlateAndShellHeatExchanger	INVALID	
Tank	VALID	
ShellAndTubeHeatExchanger	VALID	

CentrifugalPump

SubEquip	Attribute
-	TheNamePrefixAssignmentClass
-	TheNameSequenceNumberAssignmentClass
-	TheNameSuffixAssignmentClass
-	FunctionalObjectDescriptionAssignmentClass
-	DesignVolumeFlowRate
-	DesignPressureHead
-	DesignRotationalSpeed
-	UpperLimitDesignPower
Impeller	-
-	SubequipmentIdAssignmentClass
-	MaterialOfConstructionCodeAssignmentClass
-	DesignDiameterWheel
PumpCasing	-
-	SubequipmentIdAssignmentClass
-	UpperLimitDesignPressure
-	LowerLimitDesignPressure
-	UpperLimitDesignTemperature
-	LowerLimitDesignTemperature
-	MaterialOfConstructionCodeAssignmentClass

PlateAndShellHeatExchanger

SubEquip	Attribute	Validity Type	Reason
-	TheNamePrefixAssignmentClass	VALID	
-	TheNameSequenceNumberAssignmentClass	VALID	
-	TheNameSuffixAssignmentClass	VALID	
-	FunctionalObjectDescriptionAssignmentClass	VALID	
-	DesignHeatFlowRate	VALID	
-	DesignHeatTransferArea	VALID	
-	MaterialOfConstructionCodeAssignmentClass	VALID	
-	PlateHeight	VALID	
-	PlateWidth	VALID	
Chamber	-	INVALID	
-	SubequipmentIdAssignmentClass	VALID	
-	UpperLimitDesignPressure	VALID	
-	LowerLimitDesignPressure	VALID	
-	UpperLimitDesignTemperature	VALID	
-	LowerLimitDesignTemperature	VALID	
-	NominalCapacityVolume	INVALID	Could not parse "" to 'double'



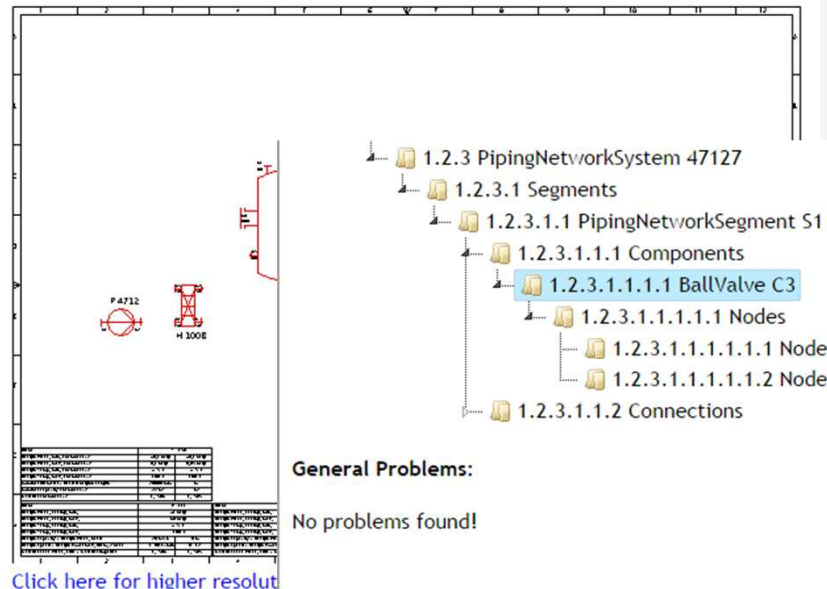
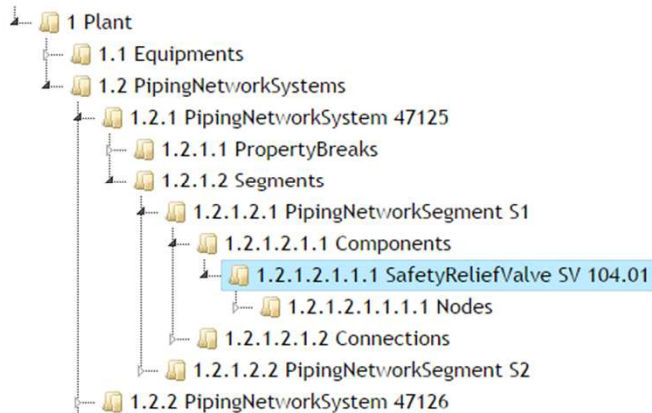
Graphical Display (new)



Your Verification Results

Navigation Tree:

Click on the small arrow to uncollaps the tree. The element data will appear under the PID image.



General Problems:

No problems found!

Type	Value
Source ID	PIPE_47127_C1
Source Line	6373

Components

Relation	Value
Nodes	1.2.3.1.1.1.1.1 Node
	1.2.3.1.1.1.1.1.2 Node

Data Attributes

Relation	Value
TagNameAssignmentClass	"C3"



DEXPI Status report



The banner at the top of the slide features a collage of images: a person holding a chemical structure, a chemical structure diagram, a flame, a test tube with green liquid, and the German flag. Logos for DEXPI (Data Exchange in Process Industry) and SusChem DEUTSCHLAND are also present.

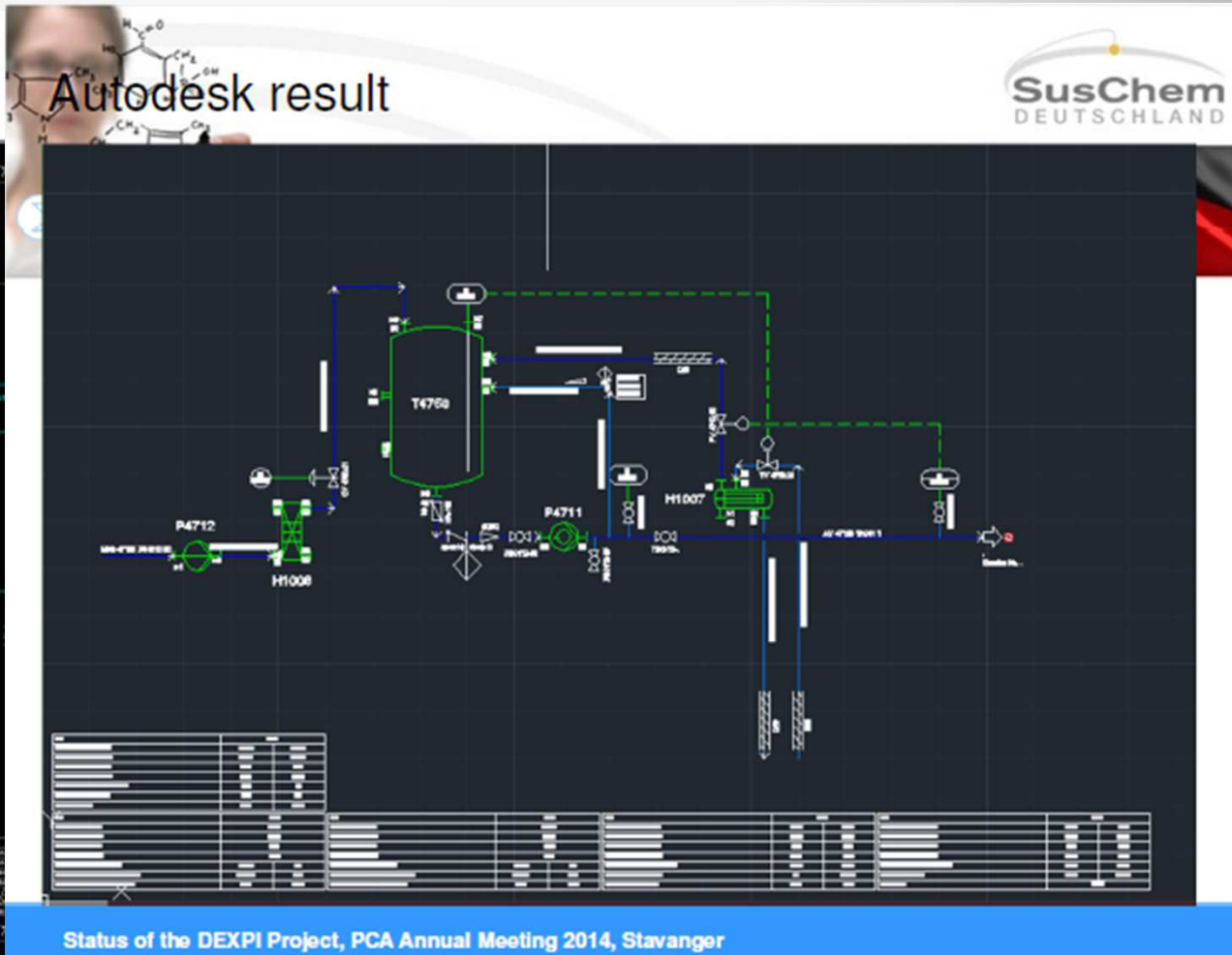
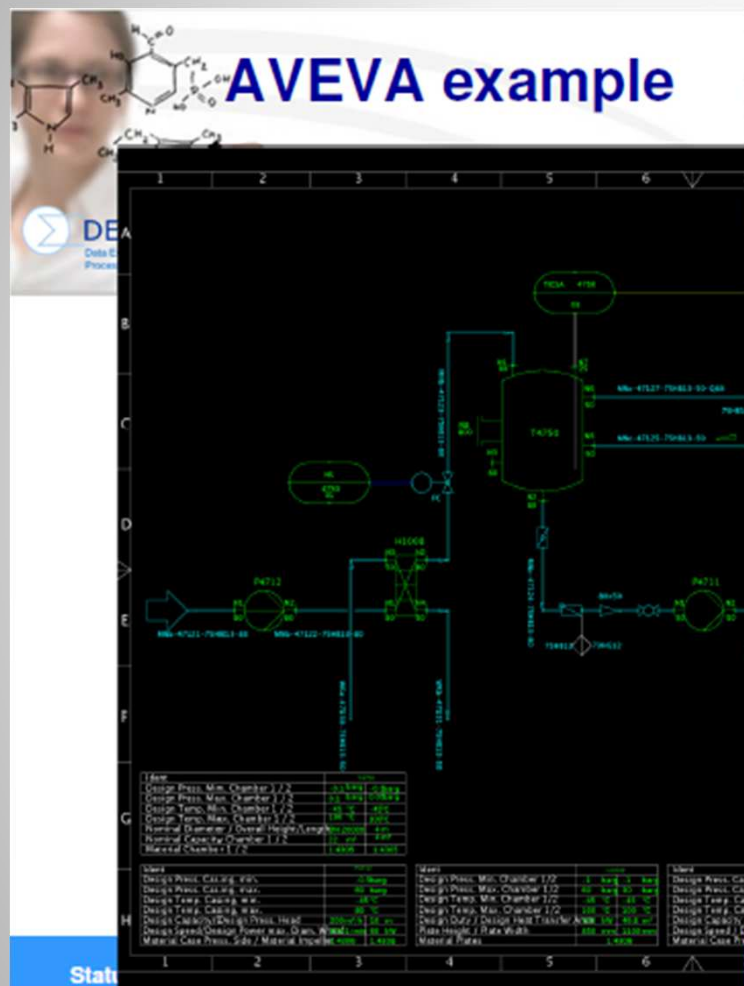
Roadmap agreement



The logos of the partner companies are arranged around a central green checkmark icon. The logos include Autodesk, AVEVA (with the tagline 'CONTINUAL PROGRESSION'), Bentley (with the tagline 'Sustaining Infrastructure'), Siemens, and Intergraph (enclosed in parentheses).

Status of the DEXPI Project, PCA Annual Meeting 2014, Stavanger

Progress report



Status of the DEXPI Project, PCA Annual Meeting 2014, Stavanger

Three points why DEXPI is different to other industry groups



Three major O/O **and** the major CAD vendors in **one** working group.



Very pragmatic approach with an agile kind of working mode.



So far, the group has stucked to it's tight schedule.



Agenda

Challenges – Why Data Exchange
DEXPI group

ISO 15926 – What's that?

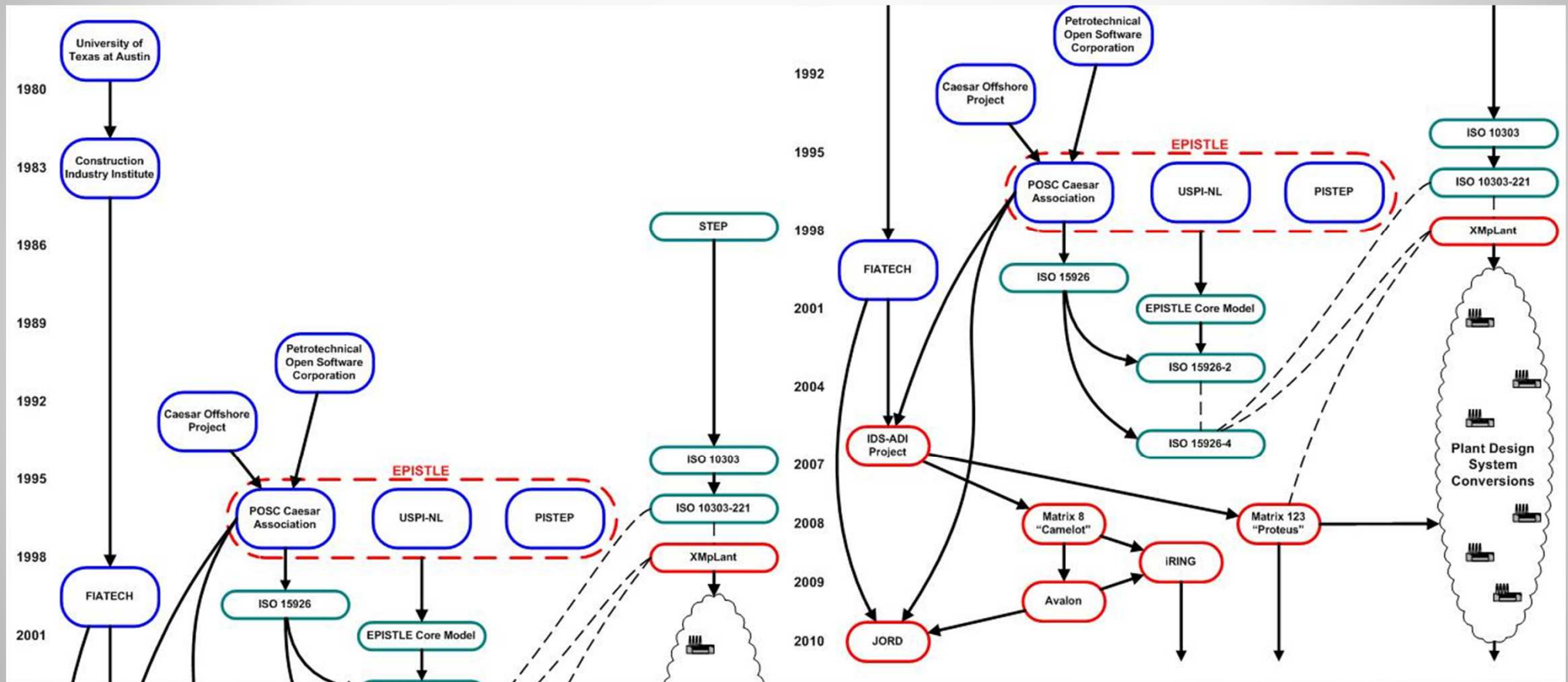
Data interchange – Current efforts

Data Interchange – Future plans

Summary and Q&A



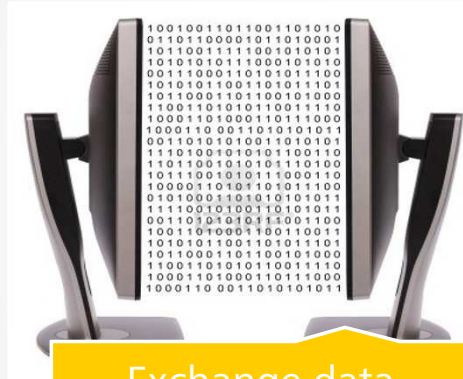
Es war einmal...



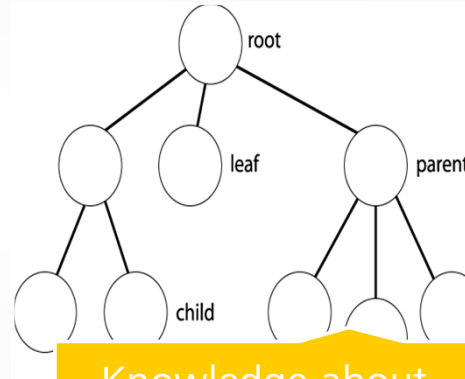
The Basic Concepts of ISO 15926



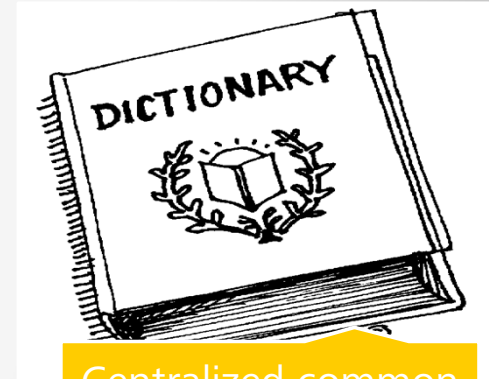
Describe the how
not the what



Exchange data
between machines

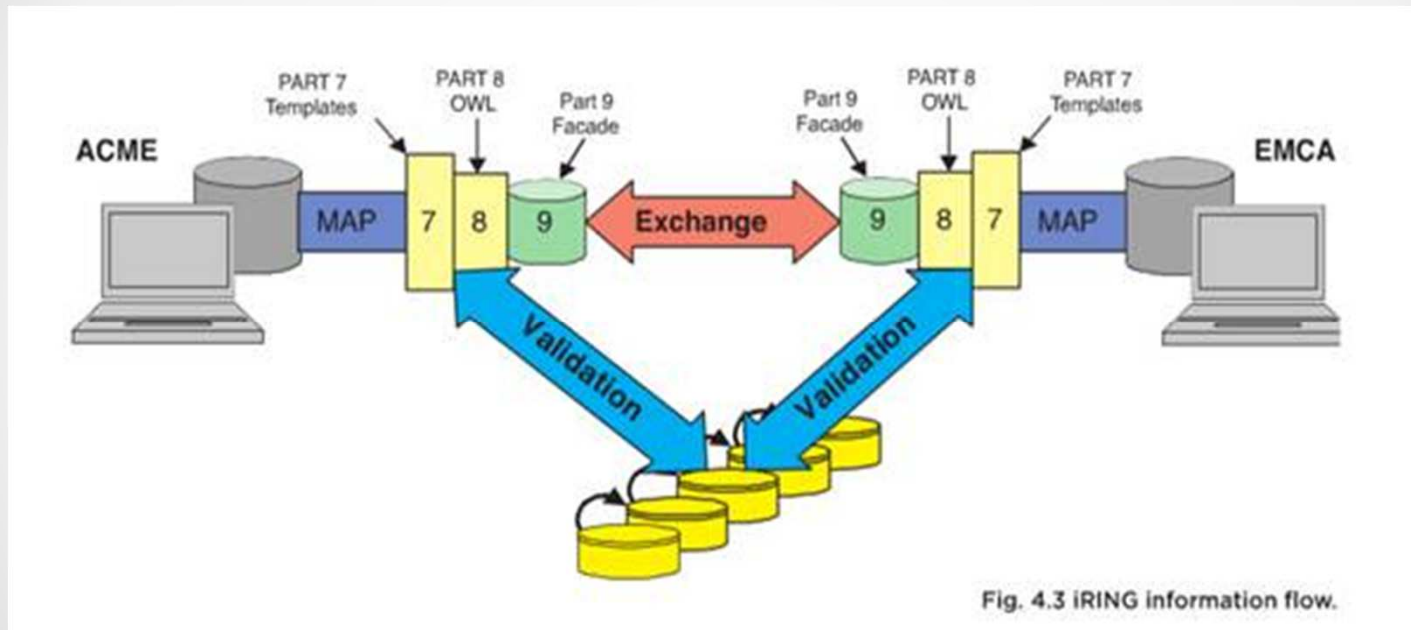


Knowledge about
family

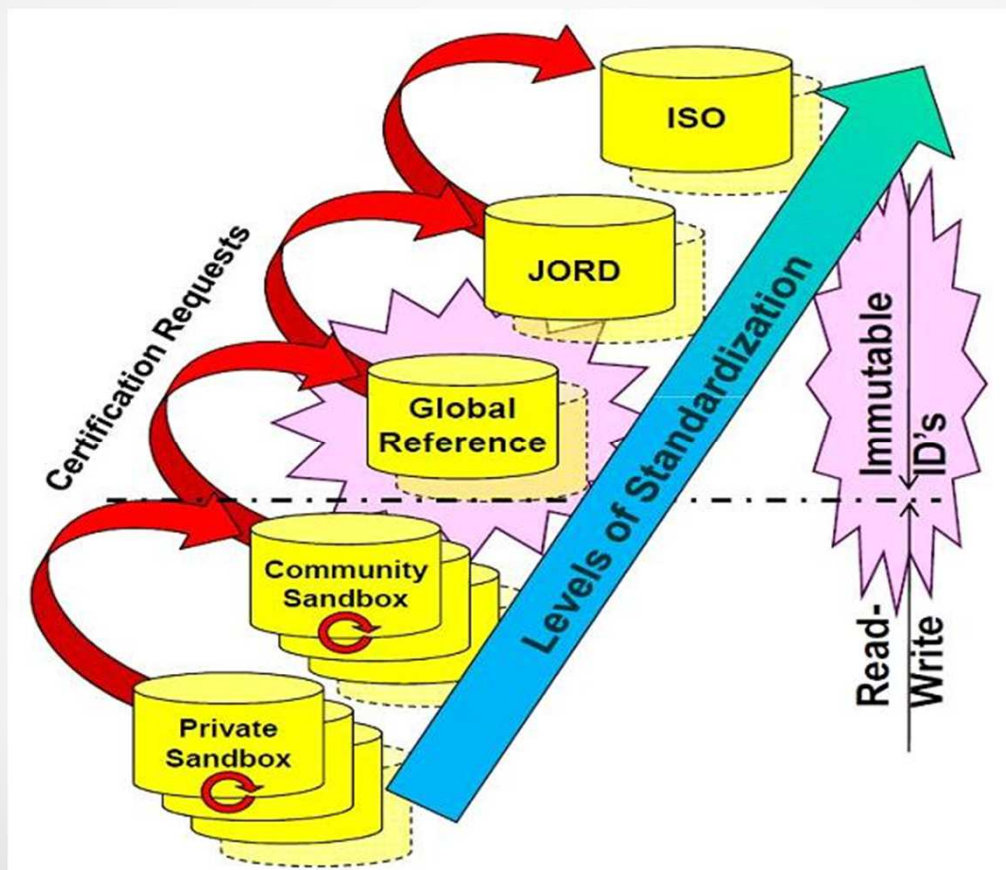


Centralized common
dictionary (RDL)

The ISO 15926 framework



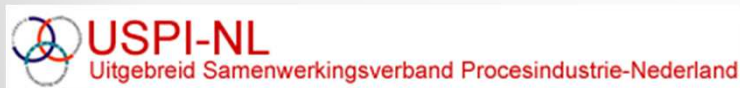
Standardization



iRING – the new name for ISO 15926

(ISO 15926 Realtime Network Interoperability Grid)

■ Organisations



Open modeling issues

Equipmentliste				Seite 1 von 8	
Planung				Datum not released	
Projekt-Benennung				Herkunft COMOS Feed	
Teilprojekt-Benennung				Ausgabe 1	
Anlagen-Benennung				Teilprojektdefinition	
P0028 HEX07 01					
Pos. Nr.	Positions-Benennung	Charakteristische Daten	Werkstoffe	PS & TS	
Pos. Nr.	EQP-Typ		Raum 1	min. max. Raum 1	
TA Nr. Bau Nr.	EQP-Subtyp		Raum 2	min. max. Raum 2	Bemerkungen
1001	Wärmeaustauscher	A = 20 m ²	1.0432	10 20	bar
	Wärmeaustauscher	DN = 40		40,0 120	°C
10 4711	Rohrbündelwärmeaustauscher	<input checked="" type="checkbox"/> liegend <input type="checkbox"/> stehend		5 8	bar
		Q = 20 kW		100 110	°C
1002	Behälter, Tank, Kolonne, Silo	V = 60 m ³			bar
	Behälter, Tank, Kolonne, Silo	DN =			°C
10 4711		<input type="checkbox"/> liegend <input type="checkbox"/> stehend			bar
1003	Verdichter	Q (th) = 500 m ³ /h			°C
	Verdichter	dp = bar			°C
10 4711		n = 1/min			bar
1004	Behälter, Tank, Kolonne, Silo	P = kW			°C
	Behälter, Tank, Kolonne, Silo	V = 700 m ³	Aluminium		bar
10 4711		DN =			°C
1005	Filter	L/H = mm		30 12	bar
	Filter	<input type="checkbox"/> liegend <input type="checkbox"/> stehend		130 40,0	°C
10 4711		A = m ²			bar
1006	Maischepumpe	MESH 45 µm			°C
	Pumpe	Q = 30,00 m ³ /h	1.4408	10 20	bar
10 4711		H = 10,0 m		5 120	°C
		n = 1/min			bar
		P = kW			°C

How to specify locations ?

Object identification ?

Representation of objects / types ?

Refer to applicable standards ?

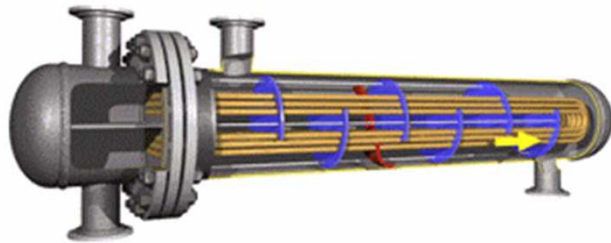
Units of measurement ?

How to model reference points (bara, barg) ?

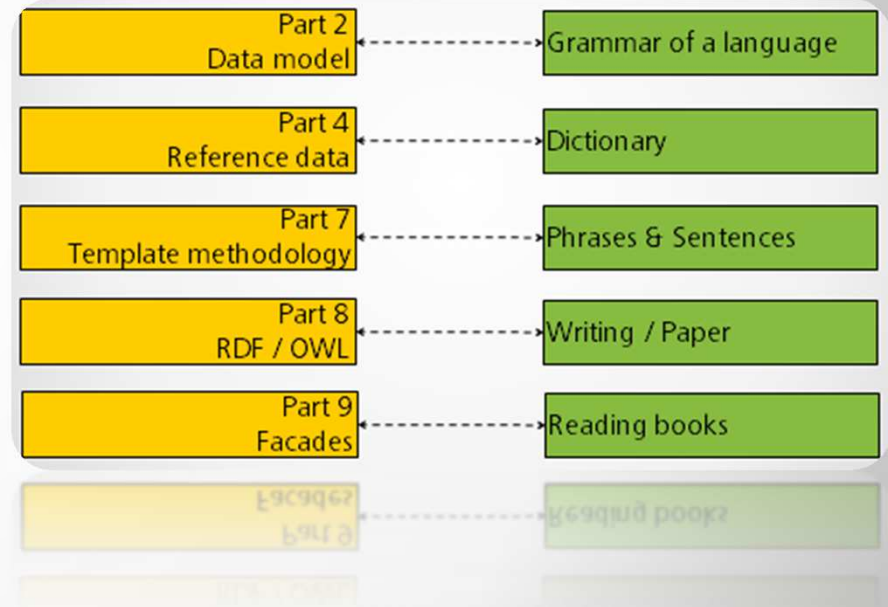
How to specify materials ?



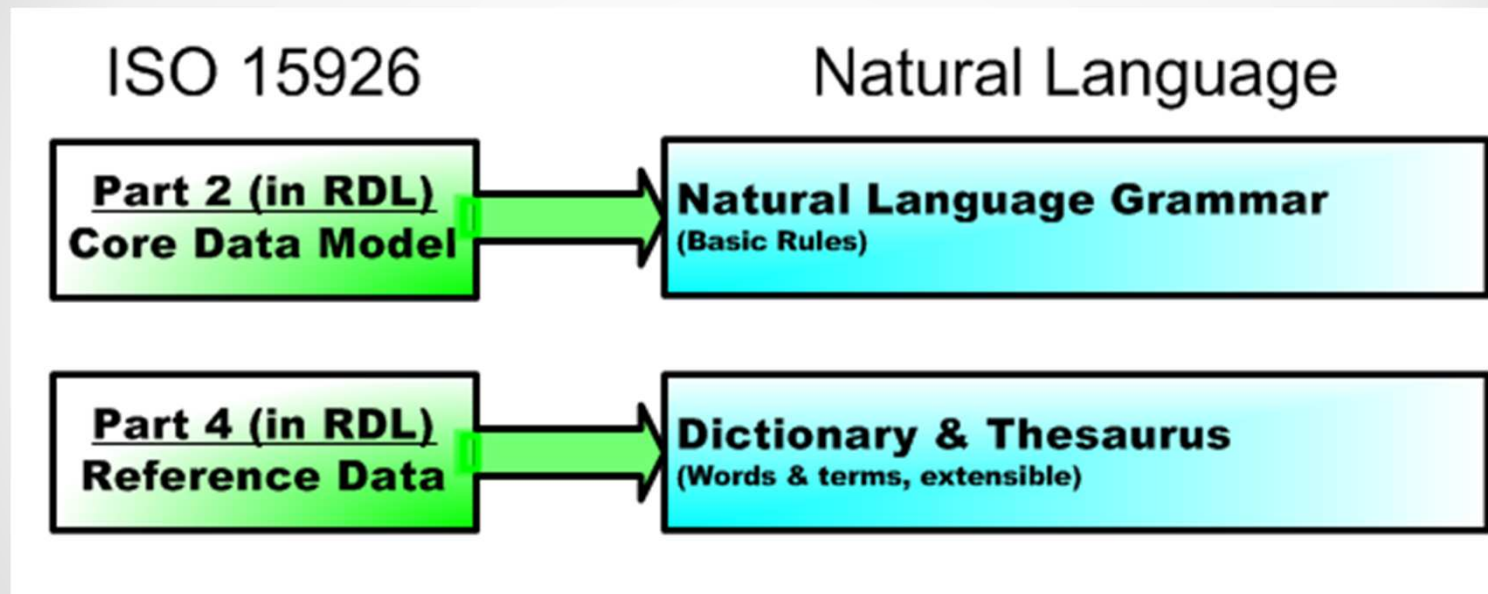
How ISO15926 works: Modelling a heat exchanger



Copyright Southern Heat Exchanger Corporation



How ISO 15926 Works - Part 2 and Part 4



ISO 15926 – part 2

ISO 15926: Part 2
Data Model

Notation

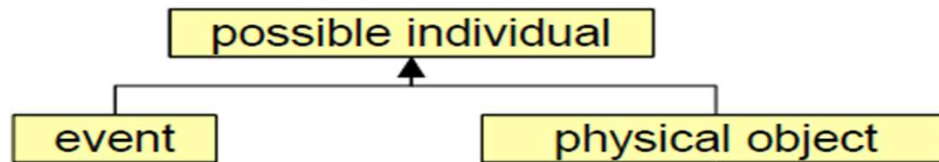


specialization, e.g.: an *event* is a special kind of a *possible individual*



classification, e.g., *HE231-23-1* is a *physical object*.

Note that this is a simplified UML-like representation instead of the verbose graphical notation of ISO 15926.



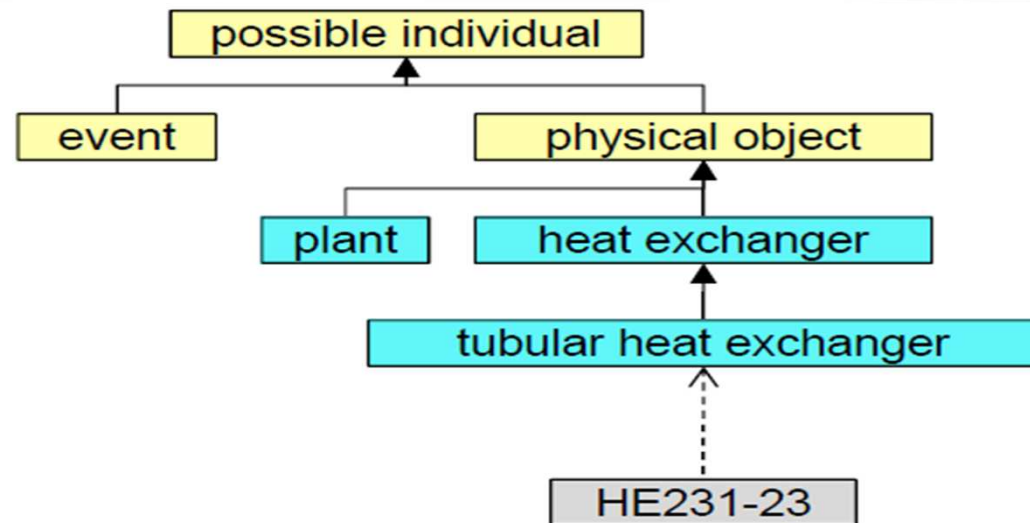
HE231-23

HE231-23 is a physical object.

ISO 15926

ISO 15926: Part 2
Data Model

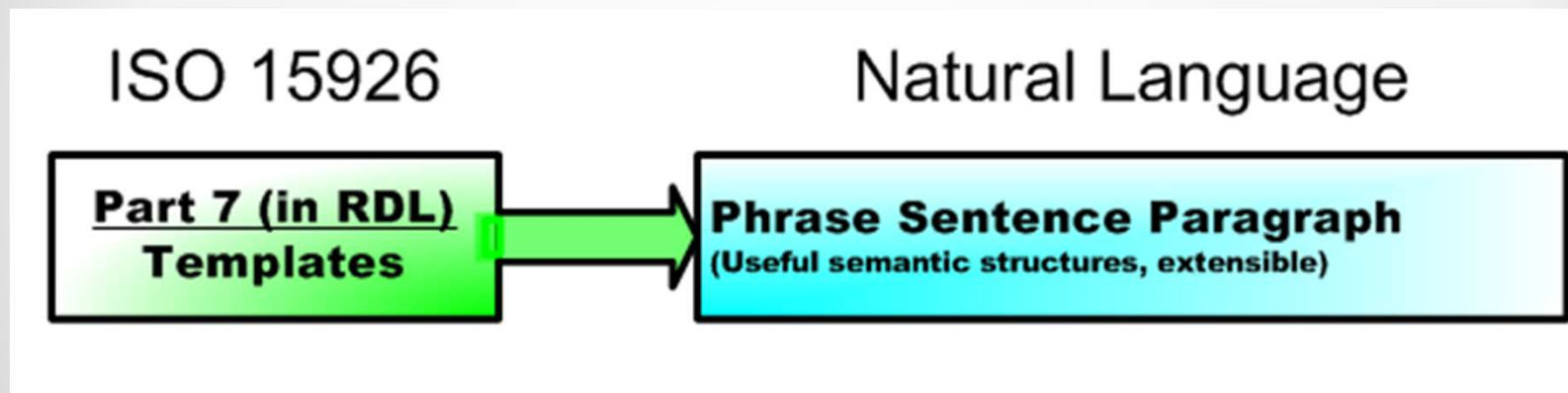
ISO 15926: Part 4
Initial Reference
Data



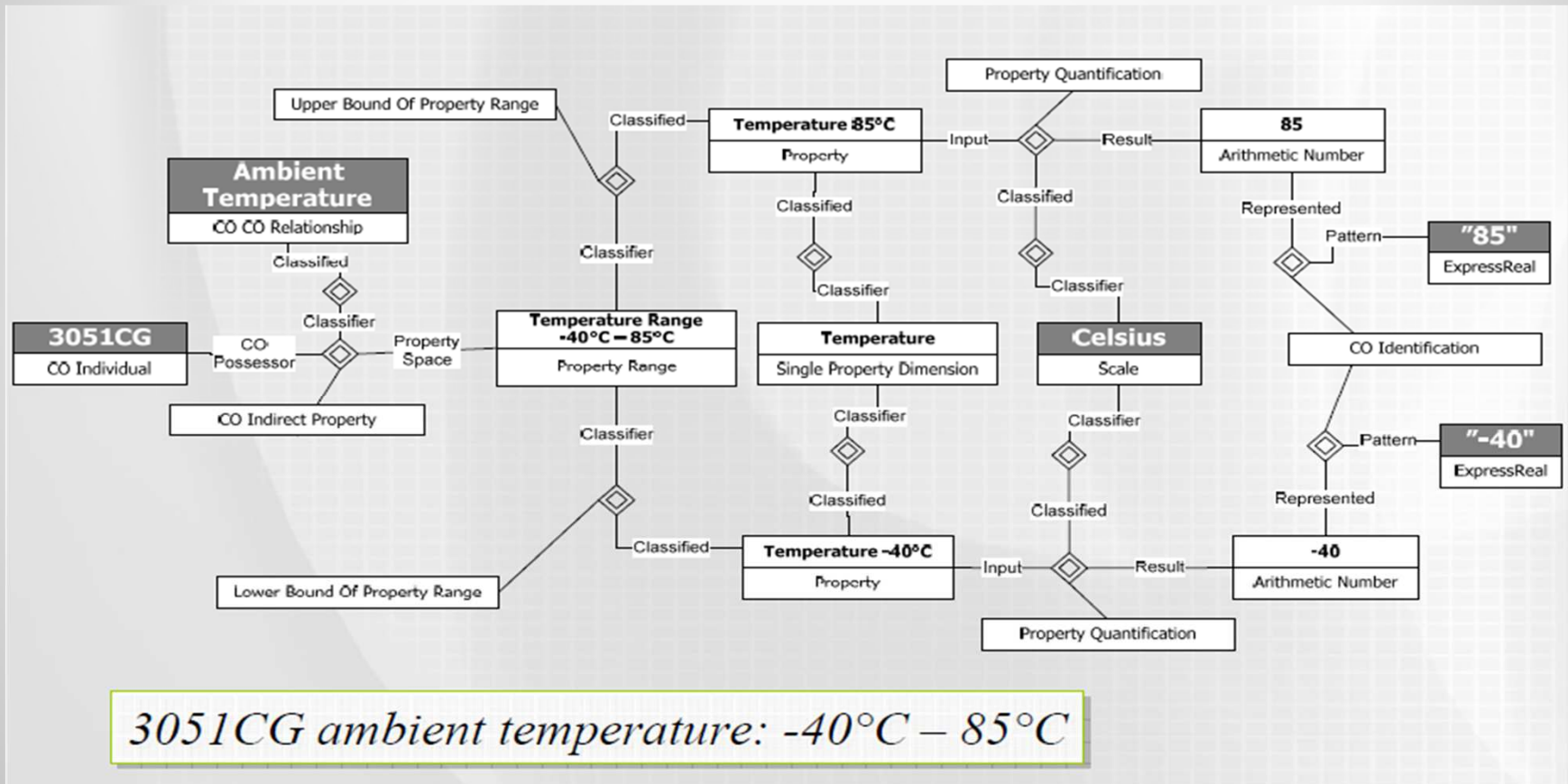
HE231-23

- is a *tubular heat exchanger*,
- has an ambient temperature range of 10°C - 30°C,
- ...

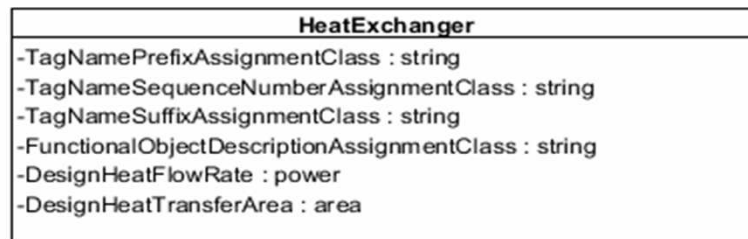
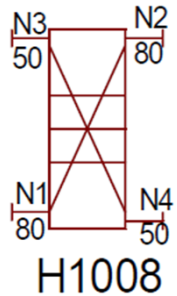
How ISO 15926 Works - Part 7



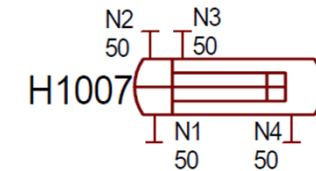
A Simple Example of a Data Record



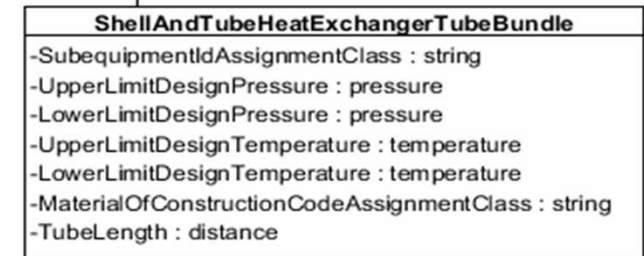
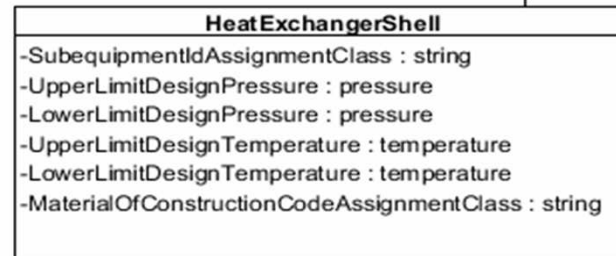
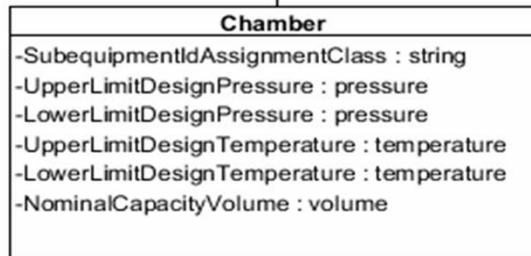
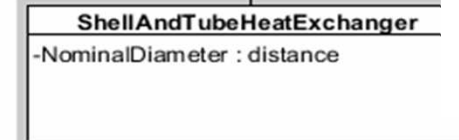
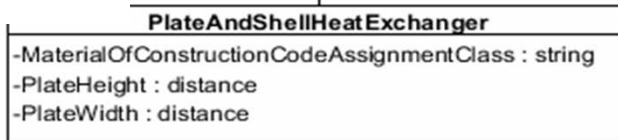
Heat Exchanger Modelling



Specialization

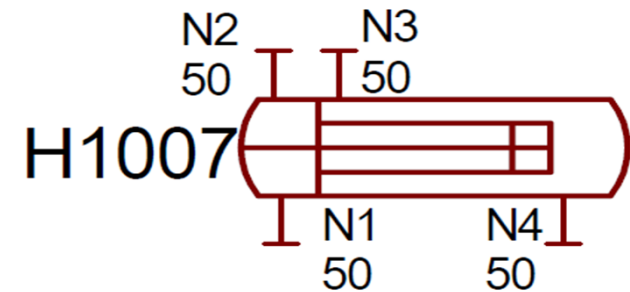


Decomposition



Heat Exchanger in the Sample PID

Here:
Shell and Tube Heat Exchanger



Ident	H1007	
Design Press. min. Chamber 1 / 2	-1 barg	-1 barg
Design Press. max. Chamber 1 / 2	60 barg	30 barg
Design Temp. min. Chamber 1 / 2	-45 °C	-45 °C
Design Temp. max. Chamber 1 / 2	100 °C	100 °C
Design Duty / Design Heat Transfer Area	313 kW	46,8 m ²
Nominal Diameter / Tube Length	DN 800	2200 mm
Material Tubes / Material Shell	1.4306	1.4308



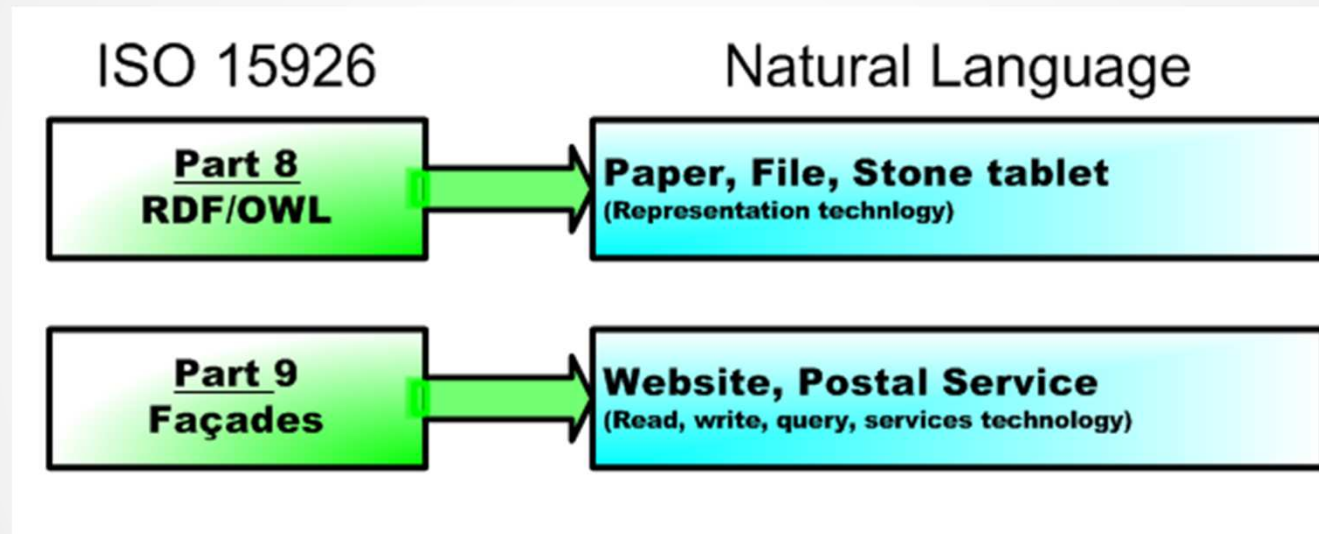
Heat Exchanger attributes

- Specifications by the DEXPI group:
 - Tag Name (e.g. „H1007“)
 - Tag Name Prefix („H“)
 - Tag Name Sequence Number („1007“)
 - Tag Name Suffix („“)
 - Description
 - Flow Rate
 - Transfer Area

HeatExchanger
-TagNamePrefixAssignmentClass : string
-TagNameSequenceNumberAssignmentClass : string
-TagNameSuffixAssignmentClass : string
-FunctionalObjectDescriptionAssignmentClass : string
-DesignHeatFlowRate : power
-DesignHeatTransferArea : area



How ISO 15926 Works - Part 8 and Part 9



DEXPI.ORG - Sandbox published

Firefox

DESIGN HEAT TRANSFER AREA | DEXPI - ...


sandbox.dexpi.org/rdl/page/DesignHeatTransferArea

Google

  **DEXPI** Data Exchange in Process Industry

A WORKING PARTY OF
PROCESSNET
AN INITIATIVE OF DECHEMA AND VDI-GVC

 **SusChem**
DEUTSCHLAND

DESIGN HEAT TRANSFER AREA at DEXPI - Data EXchange within the Process Industry
<http://sandbox.dexpi.org/rdl/DesignHeatTransferArea>

Property	Value
is p2:hasClassified of	■ dexpi:DesignHeatTransferAreaClassifiedAsDexpiPropertyClass
RDL:hasDefinition	■ An area that is available for heat transfer by design.
RDL:hasDesignation	■ DESIGN HEAT TRANSFER AREA
dexpi:hasMangledName	■ DesignHeatTransferArea
is p2:hasSubclass of	■ dexpi:DesignHeatTransferAreaSubclassOfRDS14119225
rdfs:label	■ DESIGN HEAT TRANSFER AREA
rdf:type	■ p2:SinglePropertyDimension

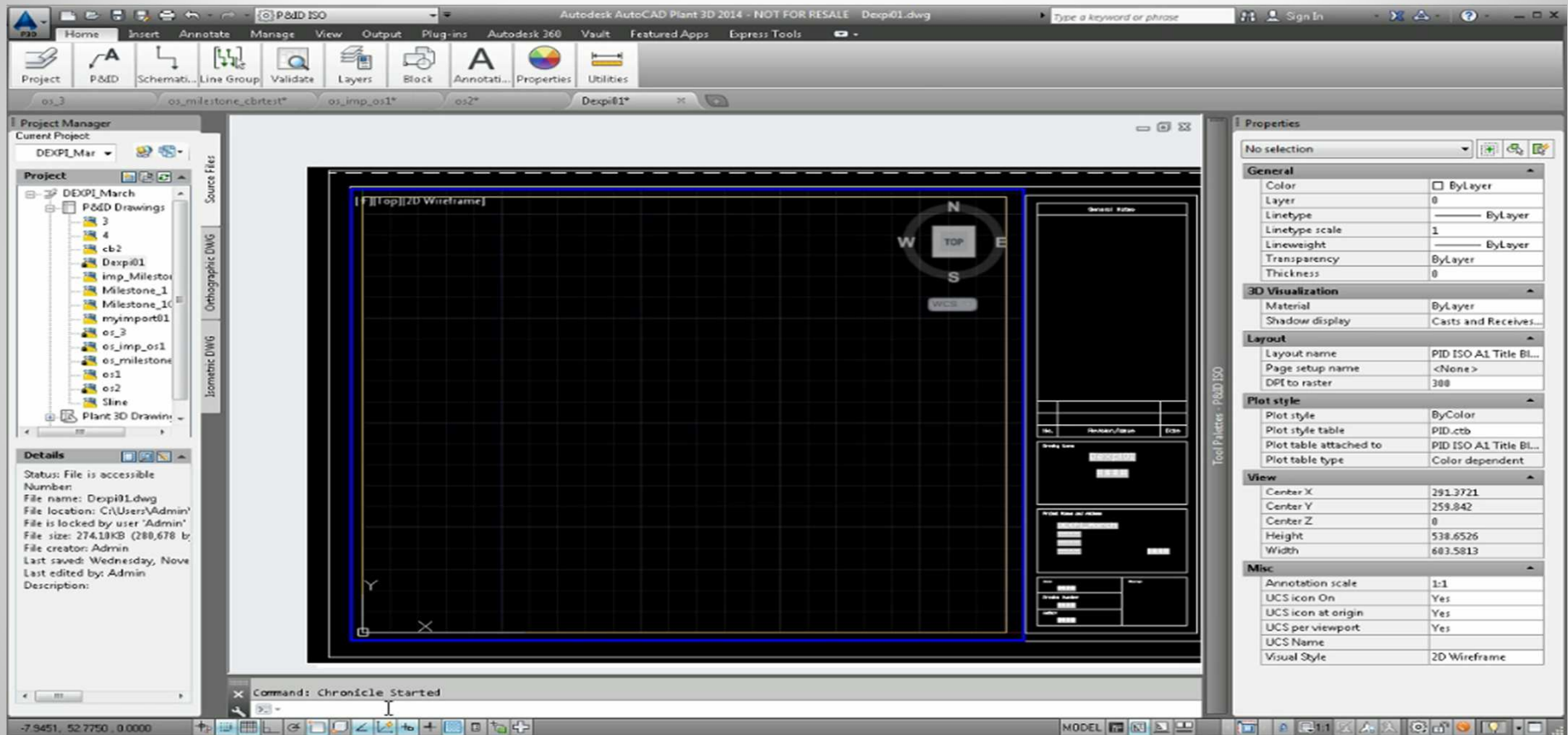
This page shows information obtained from the SPARQL endpoint at <http://sandbox.dexpi.org:3030/dexpi/query>.
[As Turtle](#) | [As RDF/XML](#)



DEXPI XMpLant Import File

[illegible]

DEXPI import video



AutoCAD P&ID imported properties

The screenshot displays the AutoCAD P&ID software interface. On the left, the 'ACPPASSET' properties window is open, showing a table of imported properties for a 'Displacement Pump'. The properties are organized into sections: Class, Tag, Styles, General, and Equipment Spec. The 'General' section is expanded, showing various attributes. Several values are highlighted with red boxes: 'DisplacementPump' for Description, 'P' for Type, '4711' for Number, and '420' for DesignVolumeFlowRate. The 'Tag' section shows 'P4711?'. The 'Equipment Spec' section shows 'P 01' for XmlID. The right side of the image shows a P&ID diagram on a black grid background, featuring a pump symbol (a circle with a square inside) and various piping and valve symbols.

Property	Value
Class	Displacement Pump
Tag	P4711?
Graphical style	Displacement Pump
Description	DisplacementPump
Manufacturer	
Model Number	
Supplier	
Comment	
XmlID	P 01
Type	P
Equipment Spec	
Weight	
Material of Construction	
Number	4711
Area	?
TagNameSuffix	
Flow Capacity	
Power	
Total Dynamic Head	
Voltage	
Phase	
Frequency	
Insulation Type	
Insulation Thickness	
DesignVolumeFlowRate	420
DesignPressureHead	40
DesignRotationalSpeed	

Joint Fiatech, MIMOSA, PCA RDL Workshop

SEPTEMBER 10, 2014 – HOUSTON, TEXAS



*„On behalf of Ken Dunn (**BP** Information Technology & Services, Chief Architect Upstream), **Fiatech**, **MIMOSA** and **POSC** Caesar Association would like to invite Autodesk to participate in the Joint ISO155926 Reference Data Library (RDL) Workshop, hosted by BP in Houston, Texas on Wednesday, September 10, 2014. We would welcome and appreciate Autodesk’s participation.“*

Ray Topping, Fiatech



Agenda

Challenges – Why Data Exchange

DEXPI group

ISO 15926 – What's that?

Data interchange – Current efforts

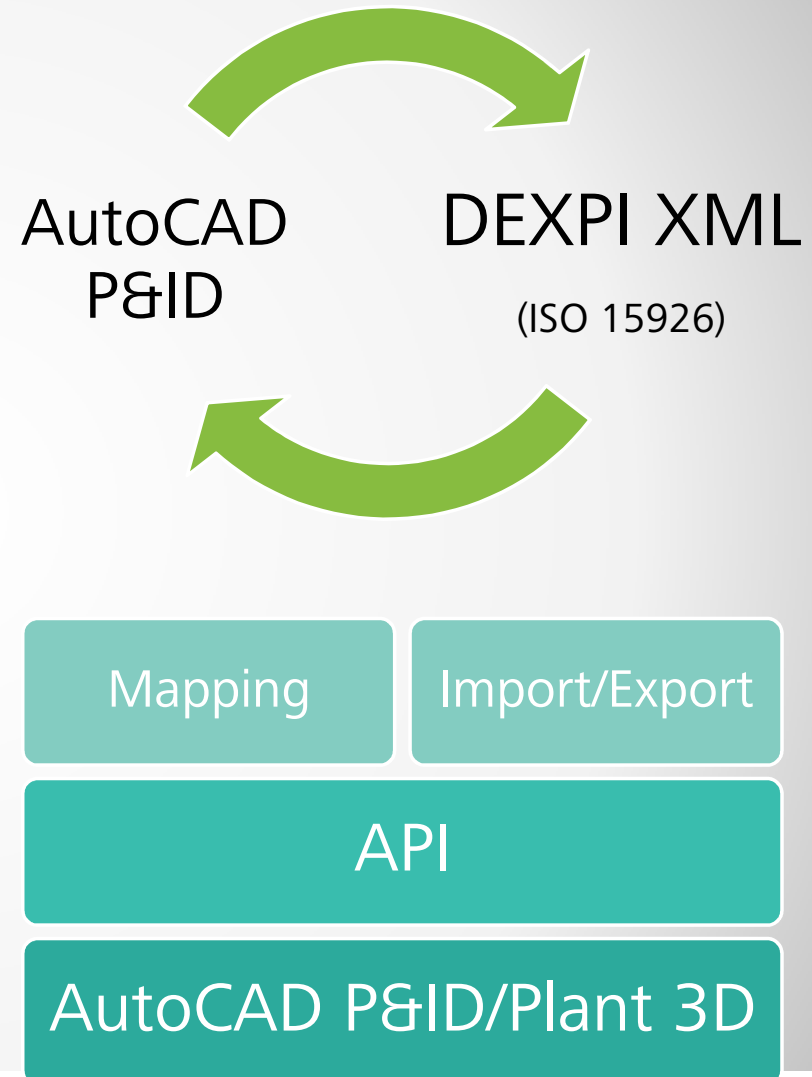
Data Interchange – Future plans

Summary and Q&A



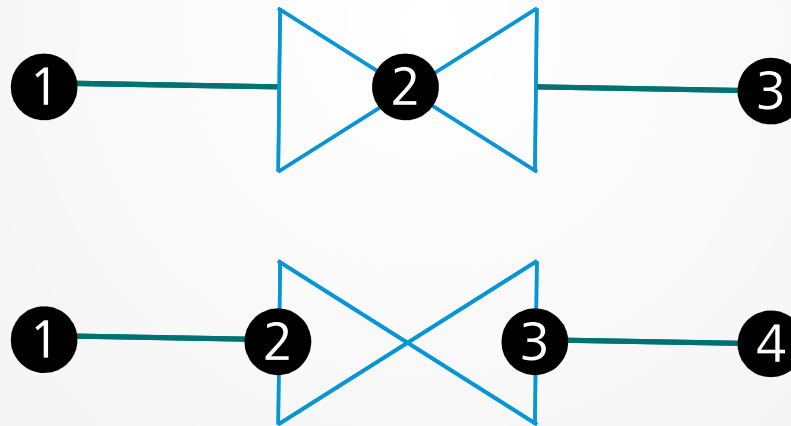
Data Interchange

- Foundation – APIs
- PDS P&ID -> AutoCAD P&ID
- Autoplant P&ID -> AutoCAD P&ID
- DEXPI and ISO 15926



Why is DEXPI Different?

- DEXPI specifies semantics
- ISO15926 just specifies grammar
- Small solution space – P&ID data/graphics only
- Example



Which is right?

Export to DEXPI XML

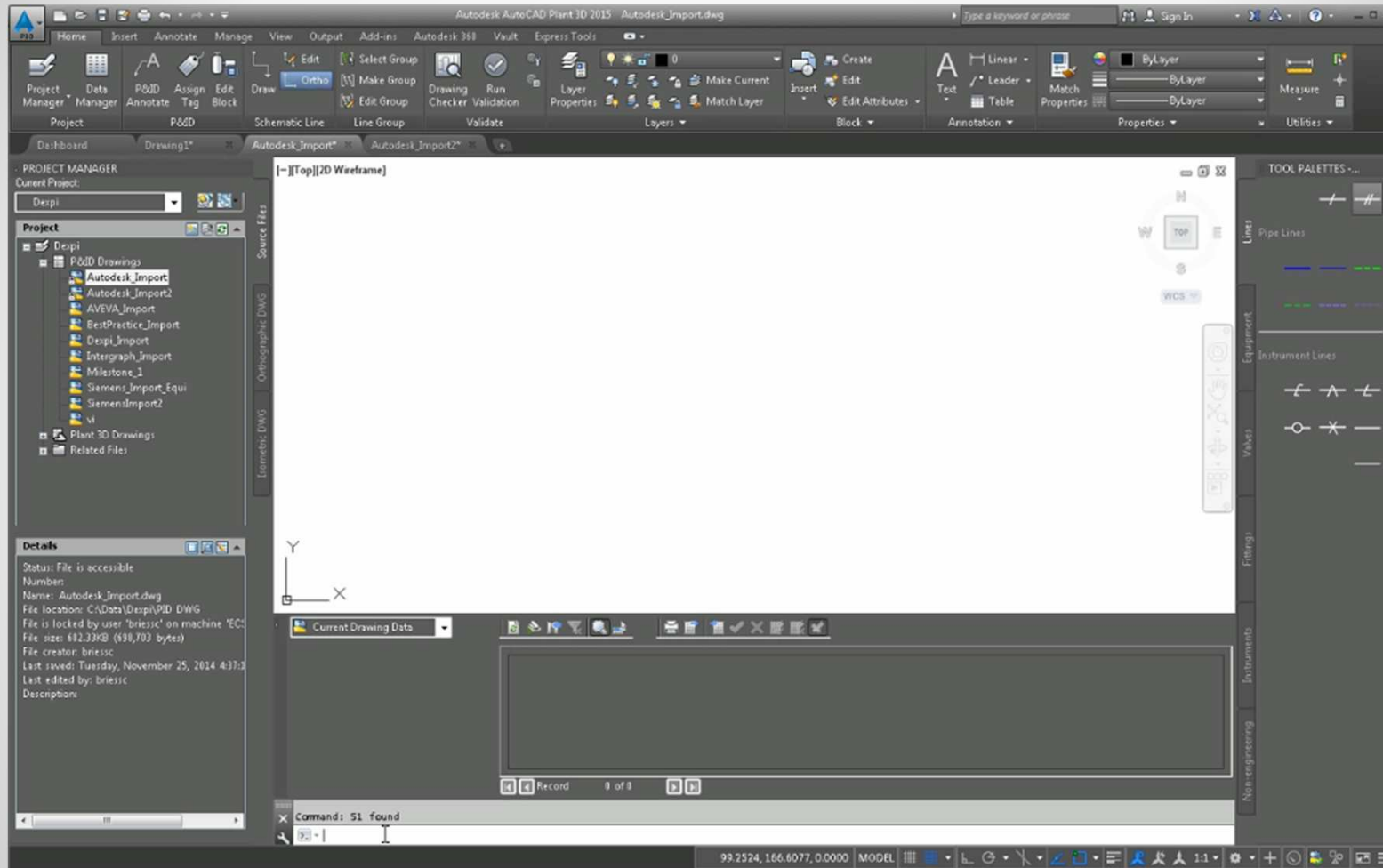
The screenshot displays the Autodesk AutoCAD Plant 3D interface. The main workspace shows a P&ID diagram titled "AutoCAD P&ID Export" with various equipment and piping. The left sidebar contains the "PROJECT MANAGER" and "Details" panels. The "Details" panel shows the file name "Milestone_1.dwg" and its location. The bottom right panel displays a table of equipment data.

AutoCAD P&ID Export

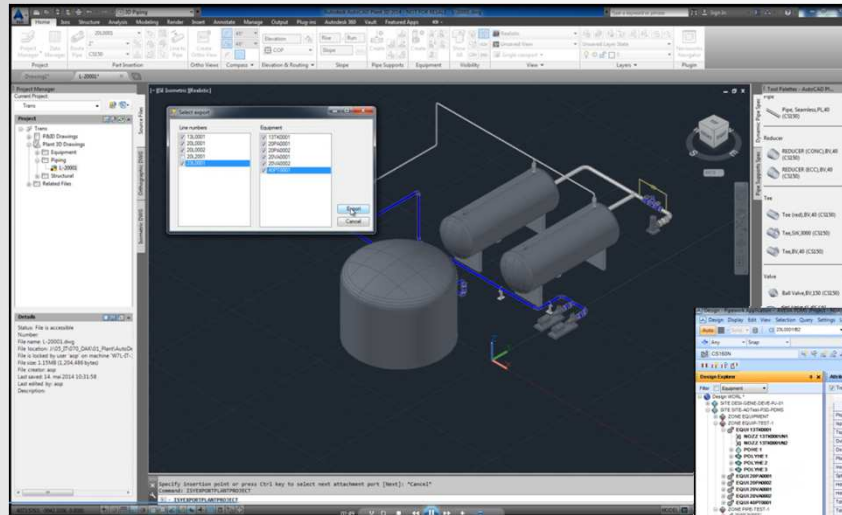
Equipment Data Table:

Tag	Type	Description	Flow Capacity	Power	Total Dynamic Head	Frequency	Class Name	PnPID	Number
P-4712	P	Process Pump	200m3/h	90kW	40m	12000	Centrifugal Pump	547	4712
P4711	P	POSITIVE DISPL...	420m3/h	84kW	10m	14000	Positive Displace...	597	4711

Create P&ID from DEXPI XML



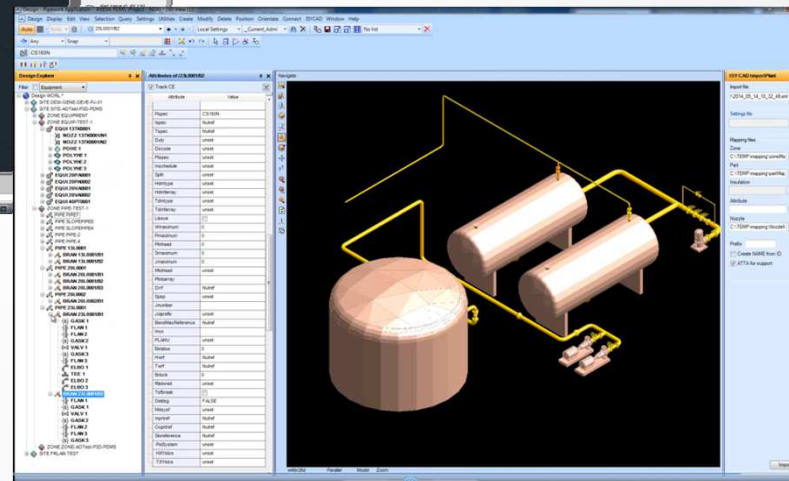
ISY Norconsult - Plant3D to PDMS



Isometric - a model imported from AutoCAD Plant 3D is an intelligent model you can generate isometrics from without doing any modifications to the model.

Our applications to import plant data into PDMS now supports AutoCAD Plant 3D. Via an XML schema our application is able to build an intelligent piping model in PDMS with equipment, nozzles and graphics.

A small plugin to PDMS is all you need to read the data that is exported from AutoCAD Plant 3D.



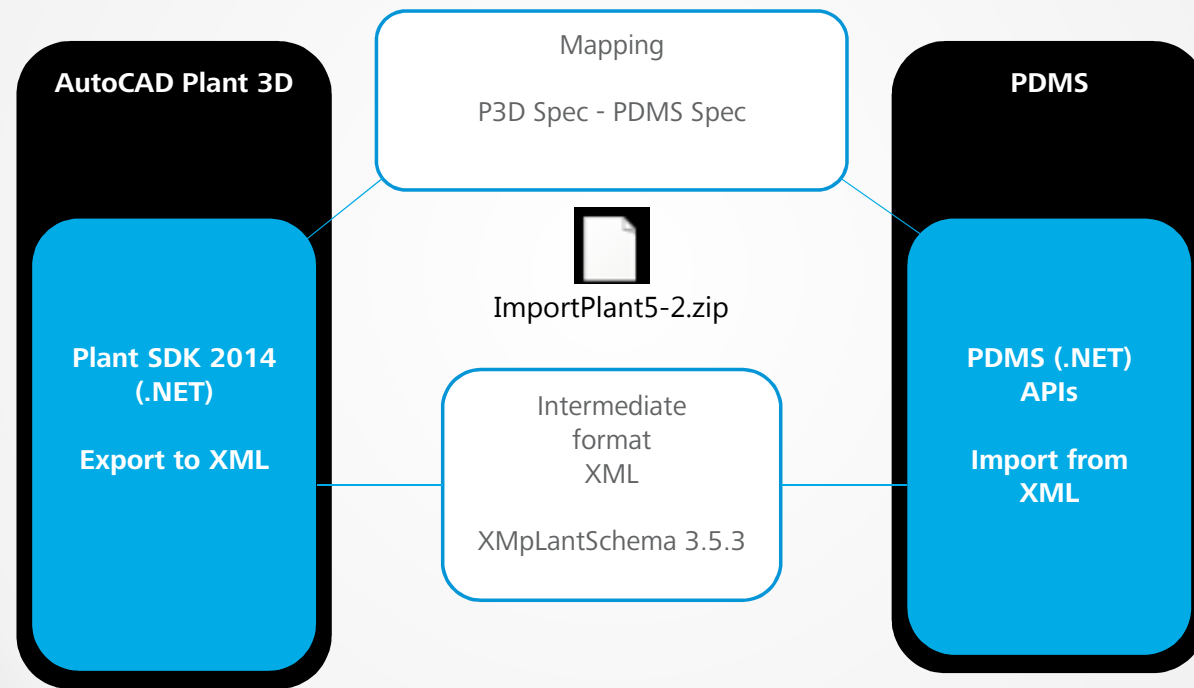
Conversion

The workflow of converting models from AutoCad Plant 3D to PDMS



AutoCAD Plant 3D to PDMS

Design conversion



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Future Plans for Data Exchange

- Maintain/enhance foundation APIs to support import/export efforts
- Data import/export of 3D models
 - Pragmatic approach
 - Import PCF
 - Export structures using Advance Steel XML format
 - Standards based approach
 - Investigating a DEXPI like approach for 3D models



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Q&A and comments



Session Feedback

- Via the Survey Stations, email or mobile device
- AU 2014 passes given out each day!
- Best to do it right after the session
- Instructors see results in real-time



