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MTP 2.0

PROFINET PROFIBUS IO-Link omlox MTP NOA

Agenda

1	Flexibility and Efficiency with Module Type Package (Thomas Tauchnitz)
2	News from the standardization: What’s new in MTP 2.0? (Mathias Maurmaier)
3	MTP Certification – plans and status (Stephan Hensel)
4	Q&A

1 Flexibility and Efficiency with Module Type Package

Flexible markets require modular plants

Classical chemical plants are optimized for high efficiency and quality

However, design and construction take many years and plants are not flexible

Challenges:

- Time to market
- Flexibilty (e.g. for resilience, market changes)
- Decentralization

Solution: Modular plants built by "Modules" that can be combined ("plug and produce")

- Allows try and error, scaling up/numbering up, tech transfer...
- Allows to re-use existing modules for new products

1 Flexibility and Efficiency with Module Type Package

Modular plants require modular automation

Skid (Module)

Production plant (Module)

Package Unit (Module)

Problem statement:

- Modules can be changed in minutes/hours
- Software integration takes several days

1 Flexibility and Efficiency with Module Type Package

Challenge for Automation

Skid (Module)

Production plant (Module)

Individual combination of modules needs common automation, monitoring, alarm handling ...

Each module hat its own automation (Controller, PLC)

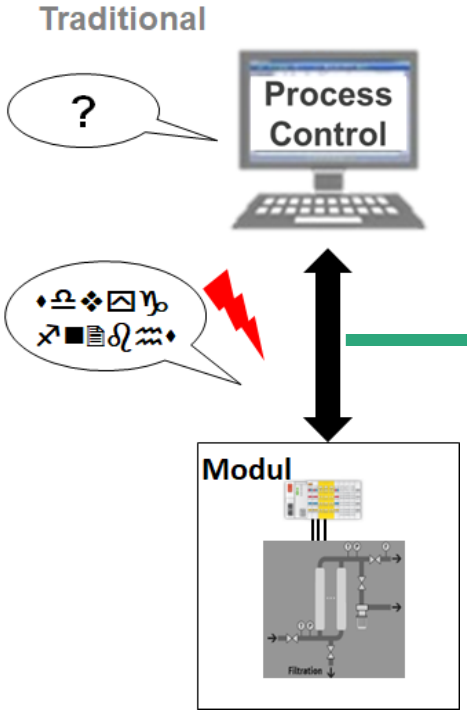
Each module hat its own instrumentation

Problem statement:

- Modules can be changed in minutes/hours
- Software integration takes several days

1 Flexibility and Efficiency with Module Type Package

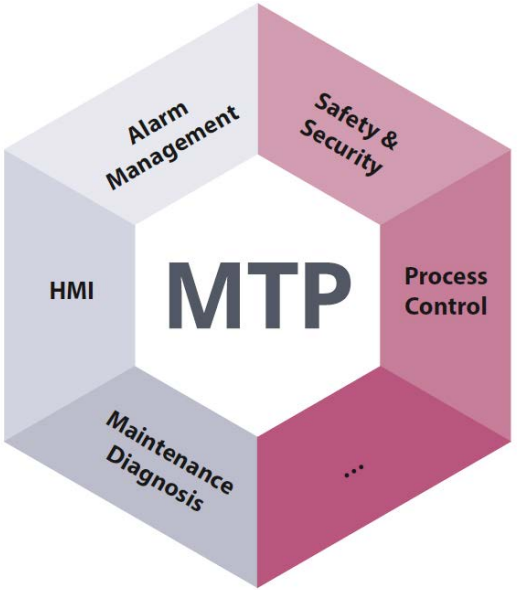
Basic Idea



called "Process Orchestration Layer (POL)"

Define standard interface between module and central control, called "Module Type Package" (MTP)

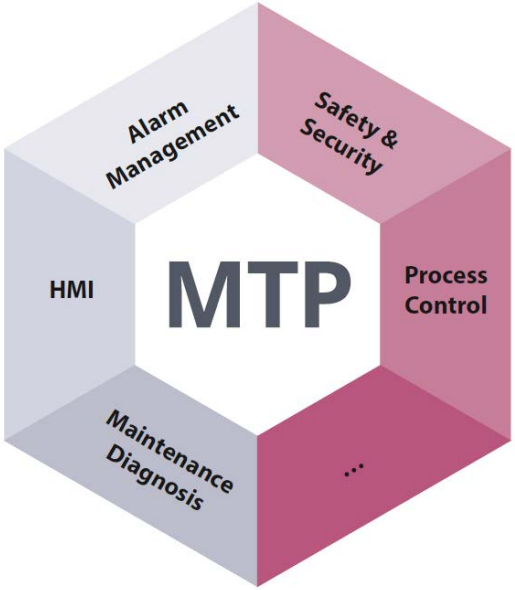
called "Process Equipment Assembly" (PEA)



1 Flexibility and Efficiency with Module Type Package

Content of the MTP file (prepared by module builder, used for orchestration engineering)

- "Services" that can be performed by PEA
- Signals from and to module (process values, commands)
- HMI for visualization of the PEA
- Alarm messages of the PEA
- (Safety and diagnosis under development)



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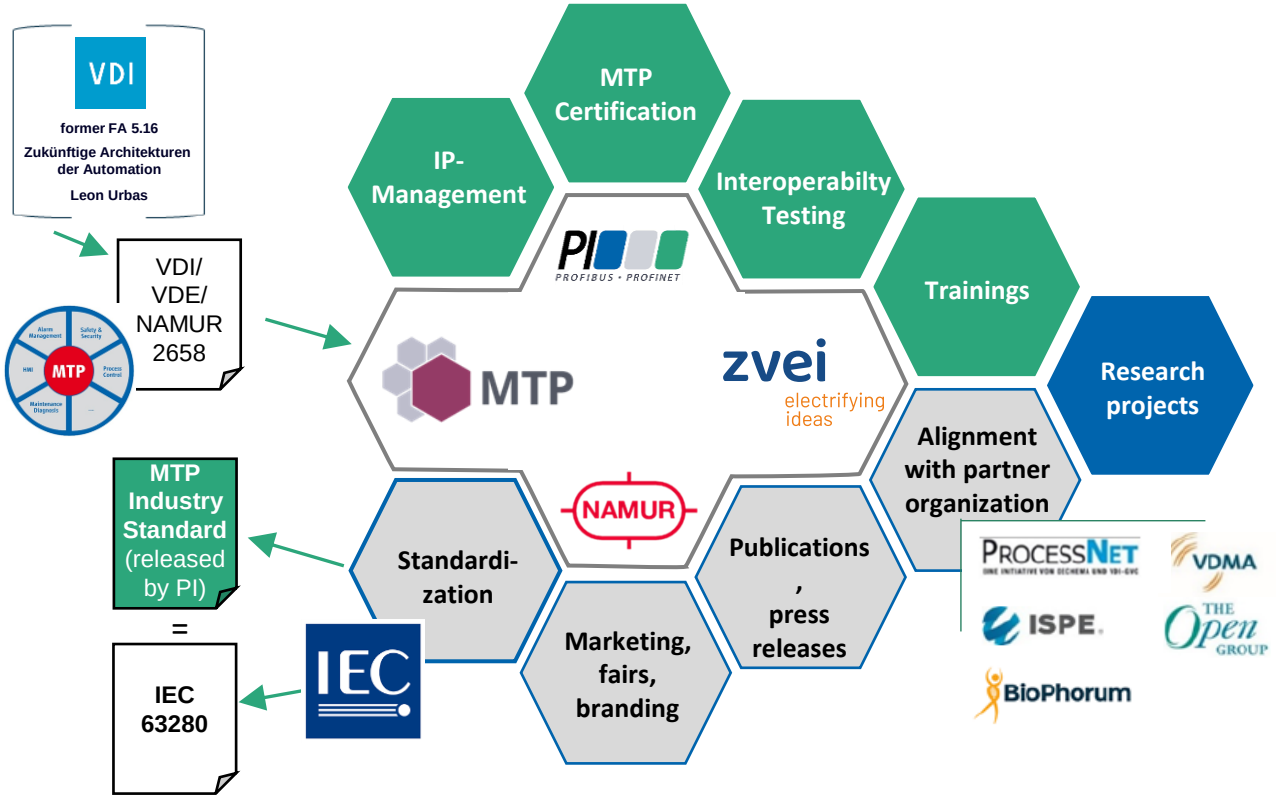
In 2023, **NAMUR, ZVEI, and PI** combined their potential to make **MTP a successful, international industry standard**

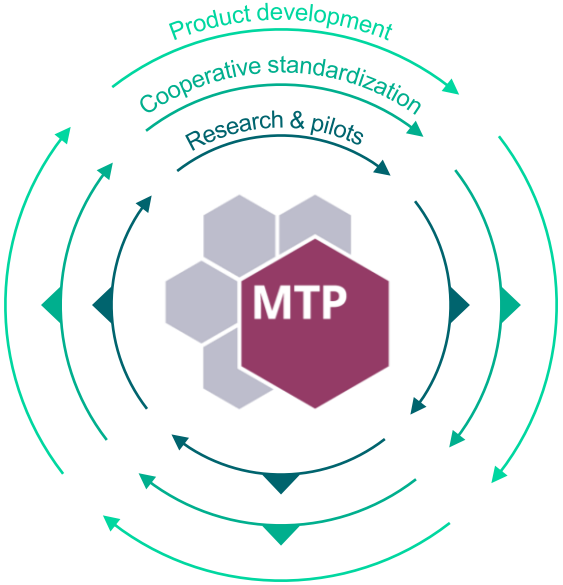


Principles of cooperation

- All members of **NAMUR, ZVEI, and PI** can get engaged in the committee and have access to documents.
- PI owns all documents and review comments of VDI/VDE/NAMUR 2658
- IP rights concerning the MTP standard owned by any partner must be granted to all other partners.
- Liaison with IEC
- Conformance tests based on accredited test labs
- Close alignment with further industry organizations

Modular automation with the MTP standard VDI/VDE/NAMUR 2658

There are many different, partially inconsistent versions.



VDI/VDE/NAMUR 2658		Version 1.0			Version 1.1				
Part	Title	CP	PD	PR	CP	PD	PR	Current situation	Products
1	Basic Concept	■	■	■	■	■		Different parts of the MTP standard are available as release, as public draft or already as improved draft.	✓
2	HMI – Concept	■	■	■	■				✓
3	HMI – Interfaces	■	■	■	■				✓
4	Process Control	■	■	■					✓
5	Runtime – Concept	■	■						✓
5.1	Runtime – OPC UA	■	■						✓
6	Alarm Mgmt. – Concept	■	■					Only concepts for alarming in modular plants have been released as public draft.	(✓)
7	Alarm Mgmt. – Modelling	■	■						(✓)
7.1	Alarm Mgmt. – OPC UA	■							
8	Safety – Concept	■							
9	Safety – Interfaces								
10	Diag./Maint. – PEA[1]	■	(NE184)						(✓)
11	Diag./Maint. – Plant								
12	PEA Qualification	■	(NE185)						(✓)
Requirements for the POL		■	(NE187)						✓

Products for PEA automation and POL systems are available for various versions of the MTP standard. Projects with products from multiple vendors have to ensure that the products fit together!

MTP as driver for **flexible production** and **package unit integration**

MTP 1.x is spreading fast to many industries

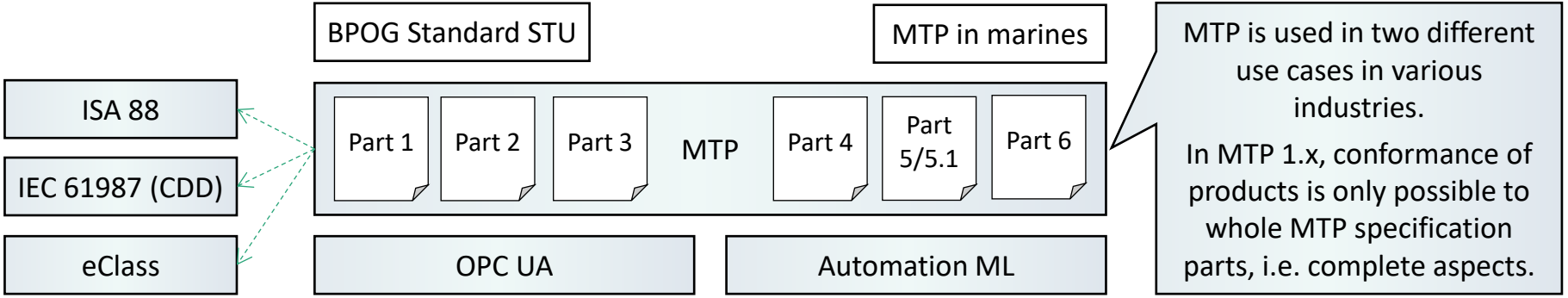
Flexible Production
- Adaptability
- Time to market

Focus on
- Functional Orchestration
- Scheduling

Package Unit Integration
- Engineering efficiency
- Time to market

Focus on
- HMI-Integration & Alarming
- Diagnostics

Manufacturing / Intralogistics | **Pharma** | **Food & Beverage** | **Chemicals** | **Marines** | **Water & Waste Water, Hydrogen**



ISA 88 alignment and Best Practice Papers

NAMUR, ISA, and PI released a position paper to align MTP and ISA 88:

→ It is possible to **implement full ISA 88 compliant PEAs with MTP**.

→ Best Practice Papaer shows, how to achieve full ISA 88 compliance with MTP

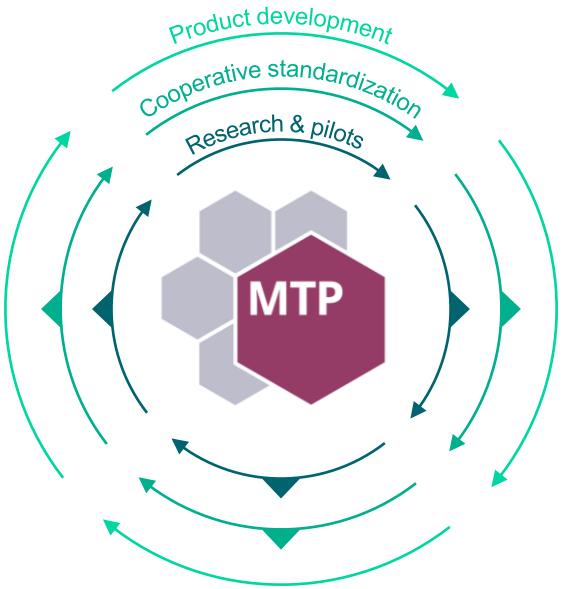
Further Best Practice Papers planned

→ HMI design with MTP

→ How to use MTP concepts on controllers with limited resources

Modular automation with the MTP standard VDI/VDE/NAMUR 2658

Release of MTP 2.0 (backward compatible) by PI, NAMUR, ZVEI in 2025



VDI/VDE/NAMUR 2658		Version 1.0			Version 1.1			Version 2.0				Updated Products
Part	Title	CP	PD	PR	CP	PD	PR	CP	PD	PR		
1	Basic Concept	■	■	■	■	■		■	■		**Public Release planned for Q1/Q2 2025.** Contents of parts 1-5 have been reorganized and clarified.	**Updated, backward compatible products are expected for 2025**
2	HMI – Concept	■	■	■	■			■	■			
3	HMI – Interfaces	■	■	■	■			■	■			
4	Process Control	■	■	■				■	■			
5	Runtime – Concept	■	■					■	■			
5.1	Runtime – OPC UA	■	■					■	■			
6	Alarm Mgmt. – Concept	■	■					■	■		All parts for alarming have been condensed into part 6	
7	Alarm Mgmt. – Modelling	■	■									
7.1	Alarm Mgmt. – OPC UA	■										
8	Safety – Concept	■										
9	Safety – Interfaces											
10	Diag./Maint. – PEA[1]	■	(NE184)									(✓)
11	Diag./Maint. – Plant											
12	PEA Qualification	■	(NE185)									(✓)
Requirements for the POL		■	(NE187)									✓

- In 2025, NAMUR, ZVEI, and PI will release **MTP V2.0** as new consistent set of documents!
- Products for MTP 2.0 and conformance tests are expected for 2025

Status of MTP Specification 2.0

Part	Title	Status
1	General Concepts, Interfaces and Models	Review Closed with 128 comments
2	Process Displays	In Member Review until Dec 20, 2024
3	Base Interfaces	In Member Review until Dec 20, 2024
4	Automation Services and Process Values	In Member Review until Dec 20, 2024
5	Runtime and Communication – General Concept	In Member Review until Dec 20, 2024
5.1	Runtime and Communication – OPC UA	In Member Review until Dec 20, 2024
6	Alarms	In Member Review until Dec 20, 2024

All parts have been restructured and reworked to comply with IEC requirements.

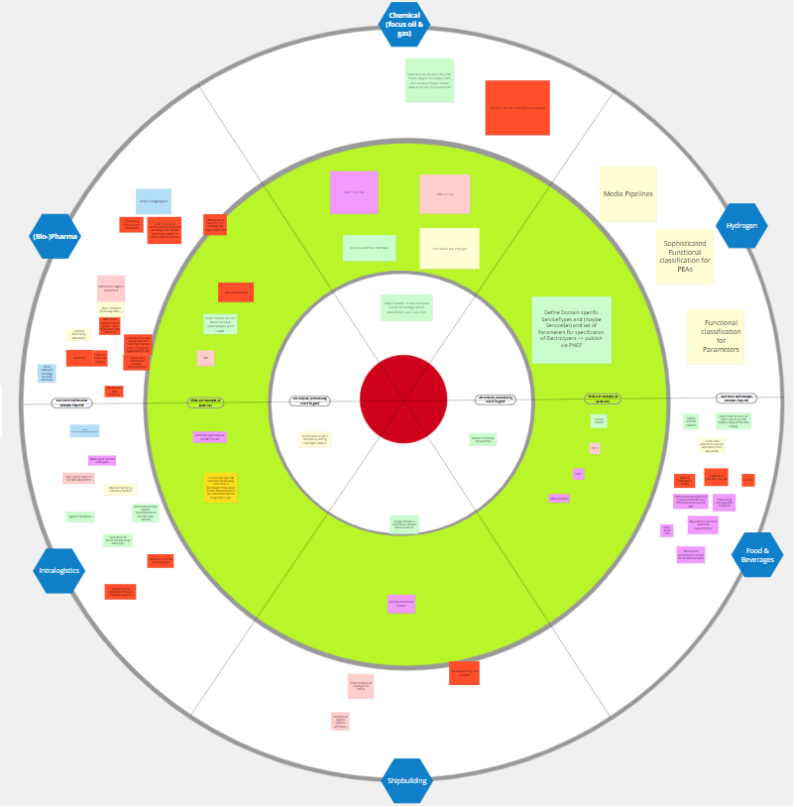
The main concepts and technologies have not been modified to ensure compatibility with MTP 1.x.

Highlights of MTP 2.0: Profiles

MTP in various industries:

- MTP is used in many different industries
- Requirements on MTP are different in different industries
- Most PEAs will be built for a specific industry

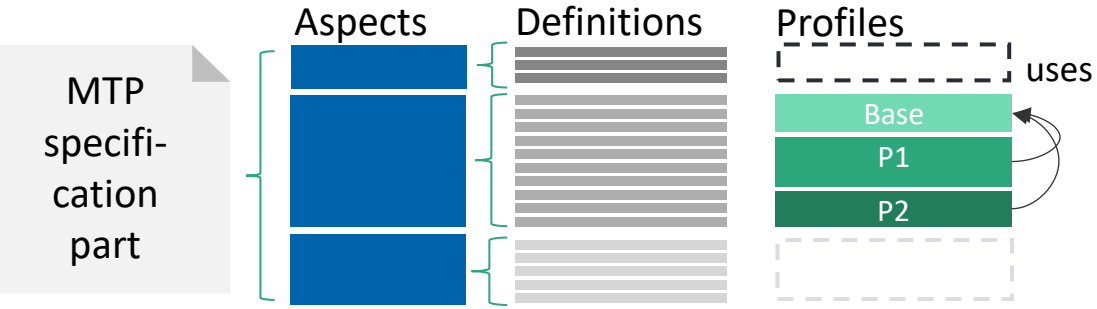
→ probably, there will not be many one fits all products



Highlights of MTP 2.0: Profiles as general concept throughout MTP Specification

- Profiles do not contain common features, but use each other
- Each MTP Specification part is subdivided into “Profiles”
- Versioning is primarily done on profiles
- Each Aspect Set requires a mandatory “Base” Profile

→Parts without profiles just have one “Base” Profile
→Improve stability of profiles throughout document versions



MTP Aspect Model “{Aspect.Base}”	
Profile ID	ModuleTypePackage:{Aspect.Base}
Version	Major.Minor.Patch

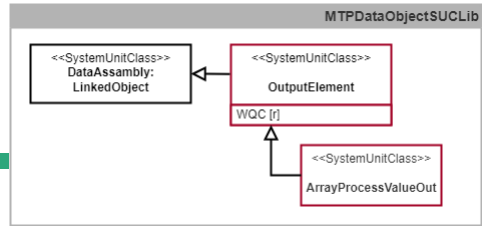
MTP Aspect Model “{Aspect.Profile1}”	
Profile ID	ModuleTypePackage:{Aspect.Profile1}
Version	Major.Minor.Patch

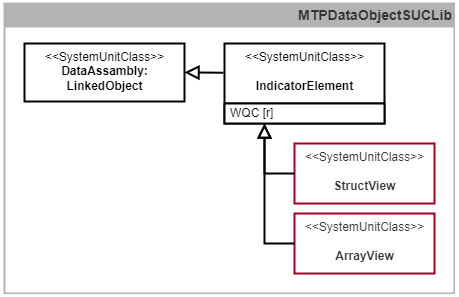
MTP Aspect Model “{Aspect.Profile2}”	
Profile ID	ModuleTypePackage:{Aspect.Profile2}
Version	Major.Minor.Patch

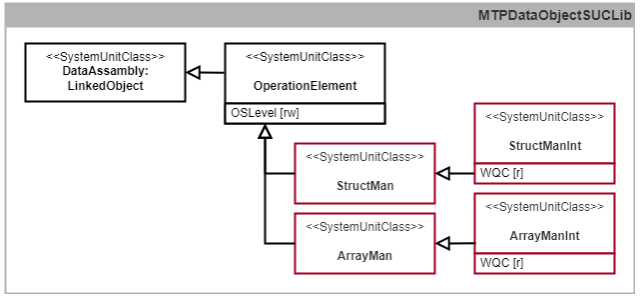
Highlights of MTP 2.0:
Profiles as general concept throughout MTP Specification

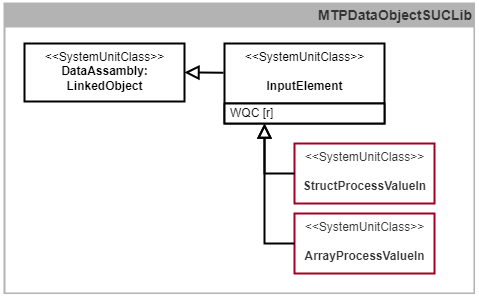
Part	Title	Profiles
1	General Concepts, Interfaces and Models	Manifest.Base TextSet.Base
2	Process Displays	HMISet.Base HMISet.PortConnector [optional]
3	Base Interfaces	DataObjects.Base DataObjects.ComplexTypes [optional]
4	Automation Services and Process Values	ServiceSet.Base ServiceSet.ComplexTypes [optional] ProcessValueSet.Base ProcessValueSet.ComplexTypes [optional]
5	Runtime and Communication – General Concept	CommunicationSet.Base (still in discussion)
5.1	Runtime and Communication – OPC UA	OpcUa.Base
6	Alarms	AlarmSet.Base AlarmSet.ManagedAlarms [optional]

Highlights of MTP 2.0
Optional profile for complex data types





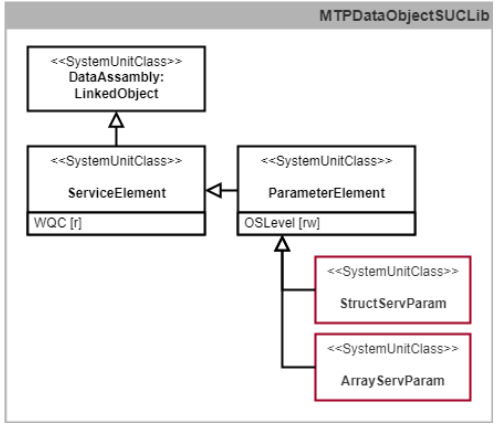




Primary use case: logistics and manufacturing (result of the research project MoProLog)

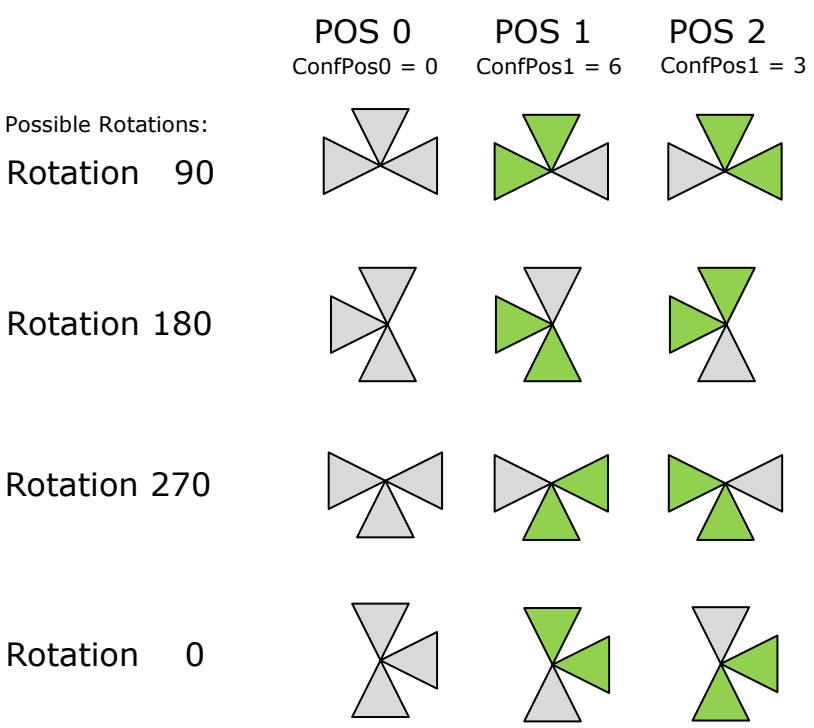
In sum 12 further data assembly definitions are introduced as DataObjects for HMI and Service parameters

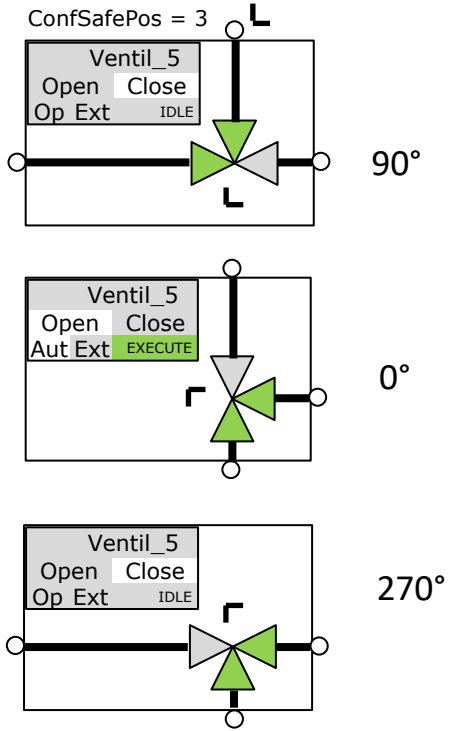
- structured data types
- array-organized data types

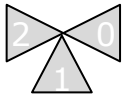


Highlights of MTP 2.0
3-way valve in DataObjects.Base

3 way valve with 3 possible positions, which can be configured by the PEA vendor







ConfPos0 = 0
(closed valve)

Conf-Enum	V0	V1	V2
0	closed	closed	closed
1	closed	closed	open
2	closed	open	closed
3	closed	open	open
4	open	closed	closed
5	open	closed	open
6	open	open	closed
7	open	open	open

Highlights of MTP 2.0 Alarming

Alarm.Base

Primary use case: lightweight alarming without alarms on local panels

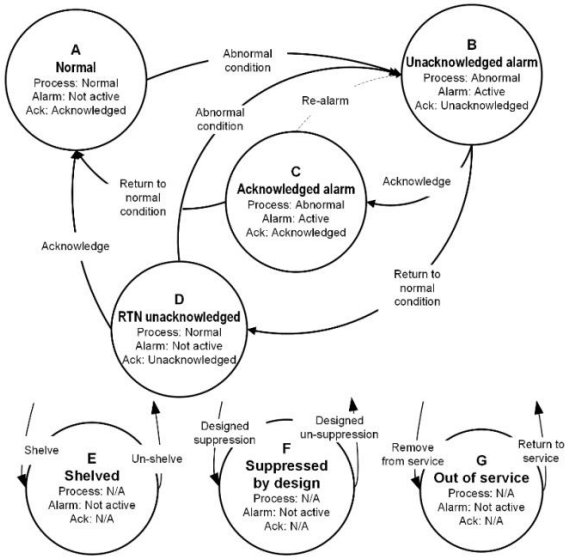
- POL-based alarms (usually Bit triggered)
- Alarm timestamp from PEA

→ correct sequence of alarms in POL

→ No alarm synchronization between POL and PEA

Common alarm state model:

(IEC 62682)



Alarm.ManagedAlarm

Primary use case: alarms on local panels in validated environments

- Alarms are managed by PEA (usually in a specífic alarm FB)
- Alarm state model is synchronized between POL and PEA via OPC UA (no OPC UA A&C used)

→ alarm synchronization between POL and PEA

Further Improvements

Packaging Scheme

Added the xsd file to the package

Source Document Infos

Defined in more detail how this information shall be used

Split Picture Models

Coordinate model as base profile, port connection based model as optional profile

Rotation for Terminations

Added rotation property to terminations

Z-Index for Connections

Added z-index property for connections

Flutter Detection

Mechanism for flutter detection simplifed

Interlock handling

Clarification of interlock mechanisms

Handshake Reworked

Removed the protocol behavior to fire-forget

Parameter Apply Behavior

Change of the behavior of the interface

Parameter Semantics

FunctionClassification for parameters added

Session Monitoring for OPC UA

Added session monitor data assembly

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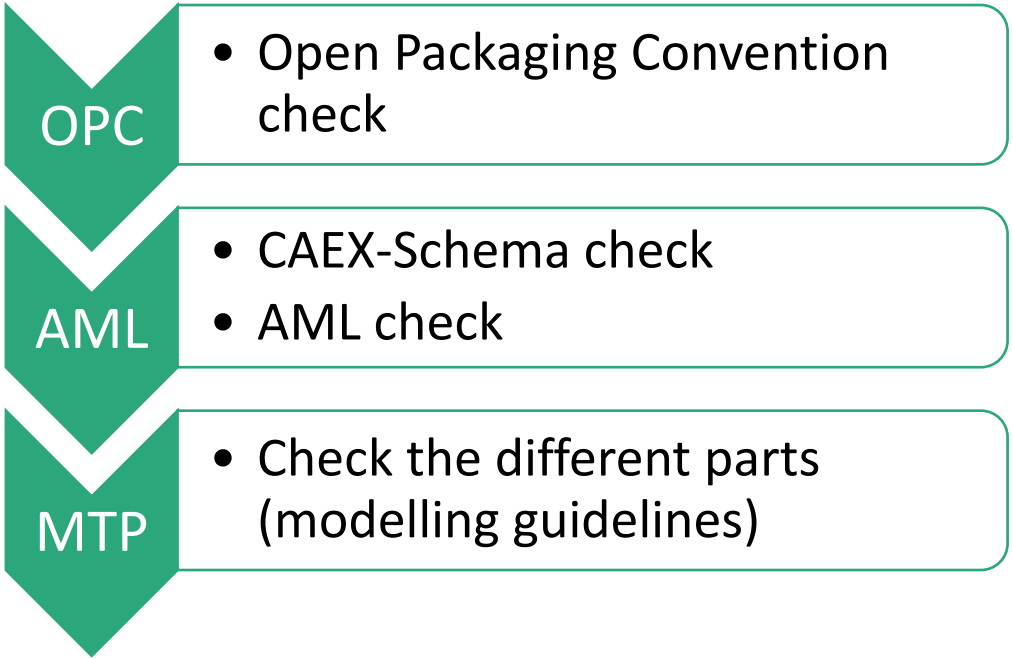
3 MTP Certification – plans and status

Goal

- Ensure Quality and Conformity
  - Improve interoperability across manufacturers
  - Enable seamless Plug-and-Produce integration
- Develop Mechanisms
  - Collect requirements for quality assurance
  - Create specifications for certification and testing
  - Define glossary
- Exchange with other groups
  - Global GAMP SIG: MTP for Pharma - Modular Plant Qualification and CS Validation
- Starting point
  - MTP file verification as a low hanging fruit

3 MTP Certification – plans and status

MTP-Verifier – basic concept



3 MTP Certification – plans and status

MTP-Verifier – basic concept

- Goal
  - Easy rule definition and maintenance
  - Support of profiles and versions
  - Formal definition of the standard
- Approach
  - Use behavior description instead of writing code
  - People who define the standard should also be able to formulate rules easily
- New rules can be written by non-developers

Solution

behavior-driven test definition using Gherkin[1] language

[1]https://cucumber.io/docs/gherkin/

3 MTP Certification – plans and status

MTP-Verifier – rule definitions like tables in the standard

523 **8.4.2 System Unit Class AnaView**

524 The *SUC AnaView*, specified in Table 28, is used to display an analog value of the PEA. It
525 contains base variables for *Unit*, *Scaling*, and the *Value*.

526 **Table 28 – DataAssembly definition of the *SUC AnaView***

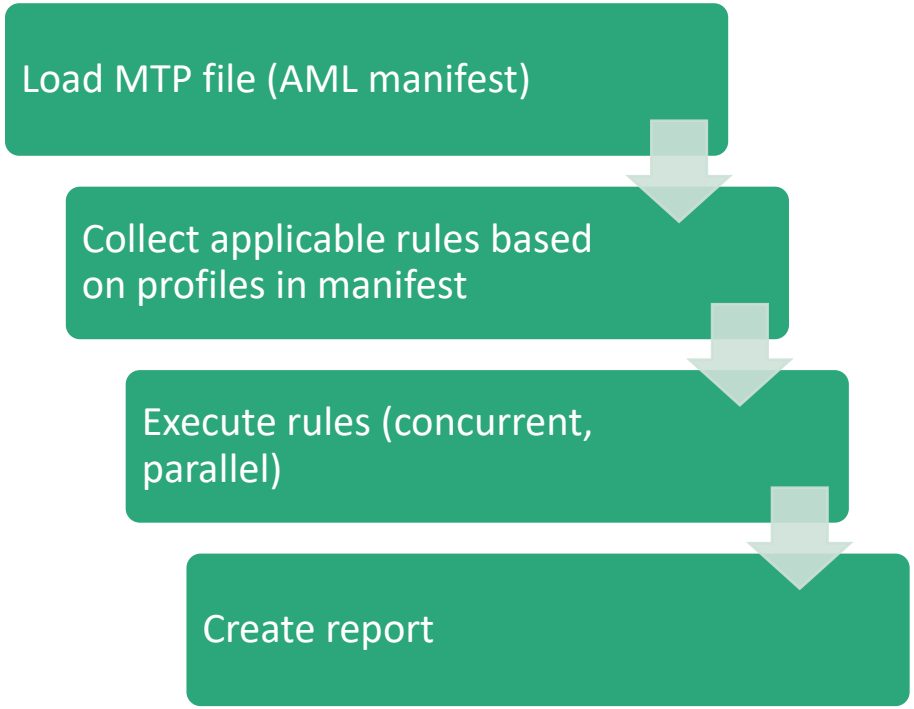
Module Type Package - DataAssembly Definition					
Name	**AnaView**				
Type	SystemUnitClass (SUC)				
Modifier					
Description	Class used to display an analog value of the PEA				
AutomationML Path	MTPDataObjectSUCLib/DataAssembly/IndicatorElement/AnaView				
AutomationML BaseRef	MTPDataObjectSUCLib/DataAssembly/IndicatorElement				
RoleClasses					
Version	ModuleTypePackage:DataObjects.Base (V2.0.0)				
AutomationML Properties					
Name	**Type**	**Description**			
–	–	–			
AutomationML Attributes					
Name	**Access**	**Type**	**Description**	**AttributeType Reference**	**Base Function**
V	POL ← PEA	REAL	Value		
VSclMin	POL ← PEA	REAL	Value Scale Low Limit		Scale-Settings
VSclMax	POL ← PEA	REAL	Value Scale High Limit		
VUnit	POL ← PEA	INT	Value Unit		Unit-Settings

```
########################################
### DataAssembly: AnaView
########################################

    @Chapter:8.4.2
    @Page:36
    @Table:28
    @ID:DataObjects.Base-0002
    Scenario: SUC: AnaView is correct
        Given 'SUC' = ITEM BY PATH 'MTPDataObjectSUCLib/DataAssembly/IndicatorElement/AnaView'
        Then 'SUC' SHALL BE ONE
        Then 'SUC' SHALL BE OF OBJECT TYPE 'SystemUnitClass'
        Then 'SUC' SHALL HAVE BASEREF 'MTPDataObjectSUCLib/DataAssembly/IndicatorElement'
        Then 'SUC' SHALL NOT HAVE SRC
        Then 'SUC' SHALL HAVE DATAASSEMBLY ATTRIBUTES ONLY:
          | Name    | Access    | AttributeDataType | RefAttributeType |
          | V       | POL < PEA | REAL              | -                |
          | VSclMin | POL < PEA | REAL              | -                |
          | VSclMax | POL < PEA | REAL              | -                |
          | VUnit   | POL < PEA | INT               | -                |
```

3 MTP Certification – plans and status

MTP-Verifier – Workflow



- Application areas of the MTP-Verifier
  - Web-based verification of MTPs (e.g. over Testlabs)
  - Third party tools (e.g. POL, PEA engineering tools, …)

3 MTP Certification – plans and status

Next steps

- Finalize MTP verification
  - Finalize implementation and rule specification
  - Description of the overall certification and signing process of MTPs
- Move to behavioral verifications e.g. library/tool certifications

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NAMUR, ZVEI, and PI are on the best way to make **MTP a successful, international industry standard**

- Since 2024 products to implement MTP are widely available
- In 2025, **MTP 2.0** and **Conformance Tests** will boost interoperability

Start your MTP projects, now!