

AutomationML Component Modell

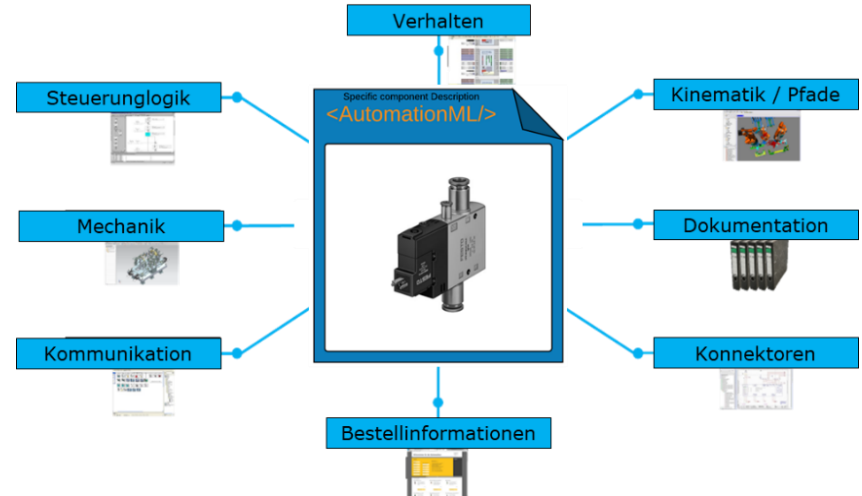
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inpro

AutomationML TechDay 2021
22. Sep. 2021

Problem



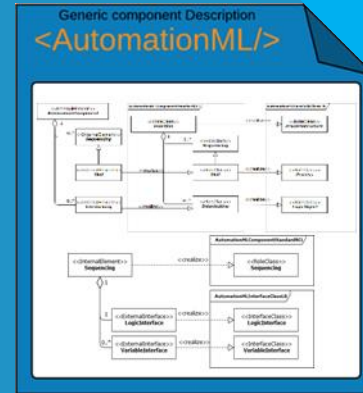
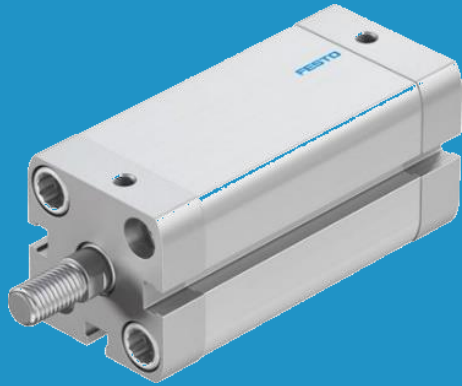
- Plants consist of a large number of subsystems and components
- When designing these systems, various aspects have to be considered and combined
- There is no open standardized model that brings together the individual pieces of information



AutomationML component enables the aggregation of almost all information about an automation component in one model, which is required for component-based engineering.

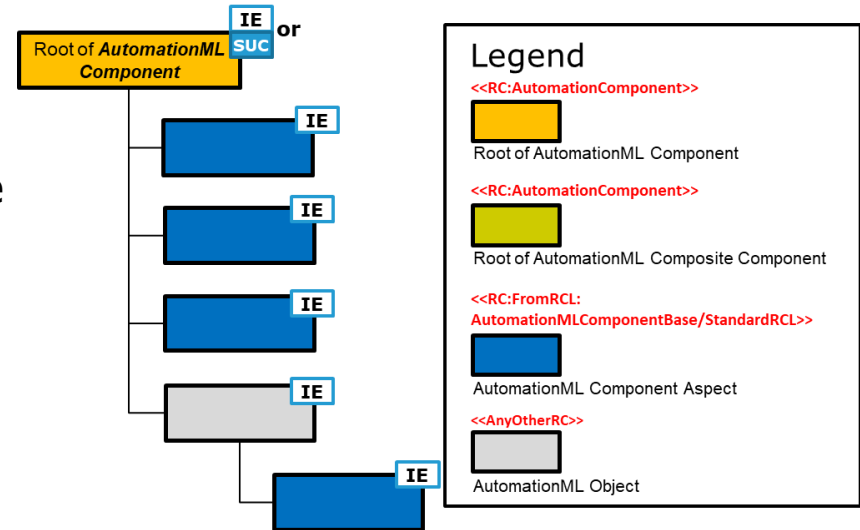
- Component description as basis for CAx
- Device description files for field devices
- Materials management and warehousing
- Extension of simultaneous engineering
- Simulation, especially virtual commissioning
- Maintenance and documentation
- AutomationML component descriptions as enablers of Model-Based Systems Engineering (MBSE)

AutomationML Components Data model

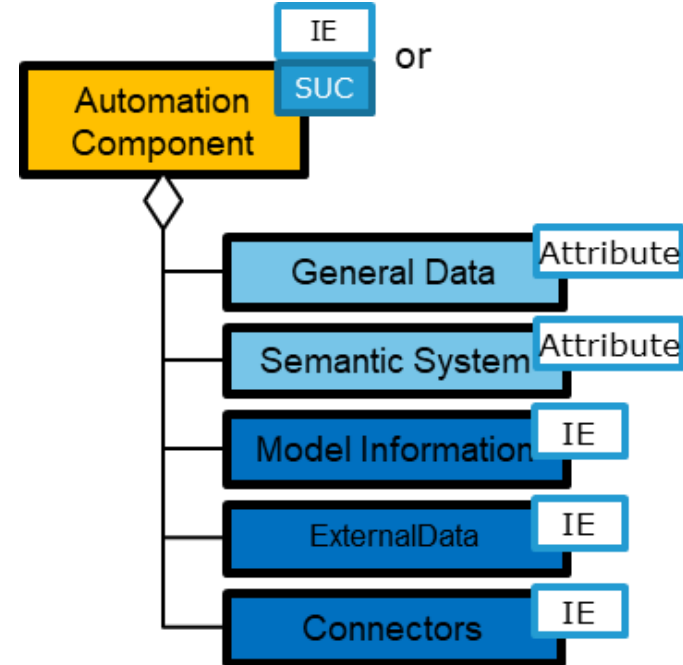


Structure of an AutomationML component

- AutomationML component a root element with the role class AutomationComponent
- Information about the AutomationML component will be stored directly in the root element in a child element
- the child elements must have a SupportedRoleClass of the AutomationML component model



- General data
 - e.g. identification data, classification data, technical information
- External data
 - e.g. documentation, symbols, pictures
- Model information
 - Behavioral and simulation models, 2D and 3D models or kinematic models
- Connectors
 - logical, electrical, pneumatic, hydraulic and other interfaces



- *AutomationMLComponentBaseRCL*

- *basic abstract role classes*
- *e.g. Model, Symbol or Documentation*

- *AutomationMLComponentStandardRCL*

- *more detailed role classes for semantic specification information*
- *e.g. GeometryModel, FMIModel, COLLADAKinematicModel*

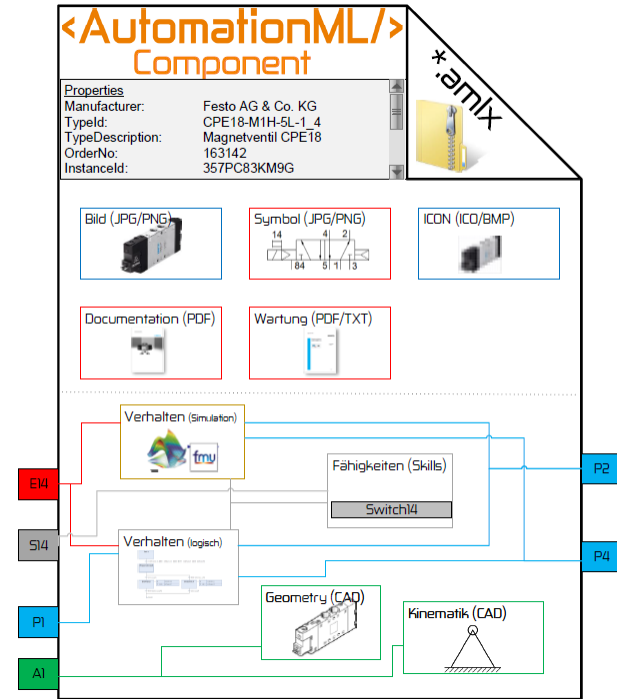
- *AutomationMLFMILogicRoleClassLib*

- *Anticipation of Update Part 4*

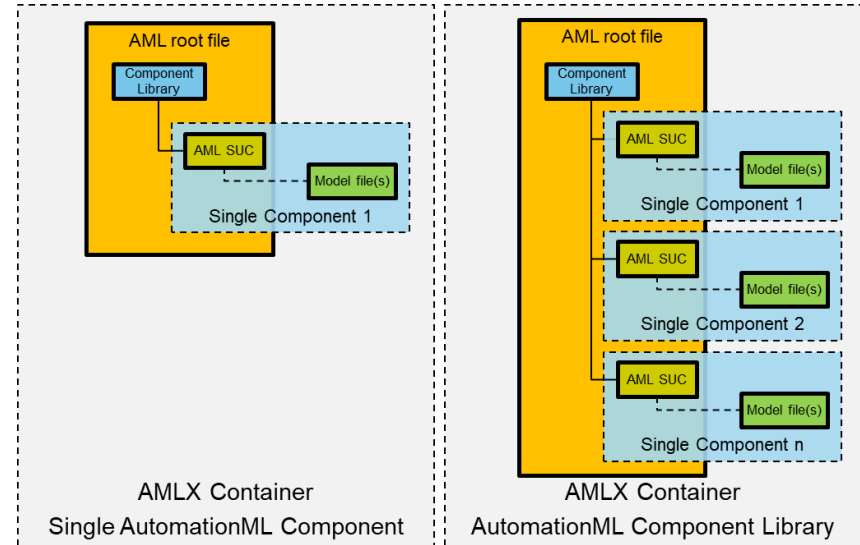
- ▲ **RCL** AutomationMLComponentBaseRCL
 - ▷ **RC** AdditionalDeviceDescription {**Class:** ExternalData }
 - RC** Connector {**Class:** AutomationMLBaseRole }
 - ▷ **RC** Documentation {**Class:** ExternalData }
 - RC** GeometryModel {**Class:** Model }
 - ▷ **RC** GraphicRepresentation {**Class:** ExternalData }
 - RC** Icon {**Class:** GraphicRepresentation }
- ▲ **RC** LogicModel {**Class:** Model }
 - ▷ **RC** PLCOpenXMLLogic {**Class:** LogicModelObject }
 - RC** AMLLogic {**Class:** LogicModelObject }
 - ▷ **RC** FMILogic {**Class:** FMILogicObject }
- RC** KinematicModel {**Class:** Model }
- RC** MaintenanceDescription {**Class:** AutomationMLBaseRole }
- RC** Model {**Class:** AutomationMLBaseRole }
- RC** Symbol {**Class:** GraphicRepresentation }

Connections of AutomationML components

- With AutomationML components different connections can be realized
 - Connections between individual model aspects
 - Connections between connectors and models
 - Connections between components to "Composite Components"
- Connections are realized via internal links between ExternalInterfaces



- AMLX is a container format
- AMLX container contains
 - root file
 - min. one AutomationML component
 - model and description files
- Use cases for AMLX Container
 - Exchange of a single AutomationML component
 - Exchange of libraries of AutomationML components
 - Exchange of detailed specified components corresponding to a profile



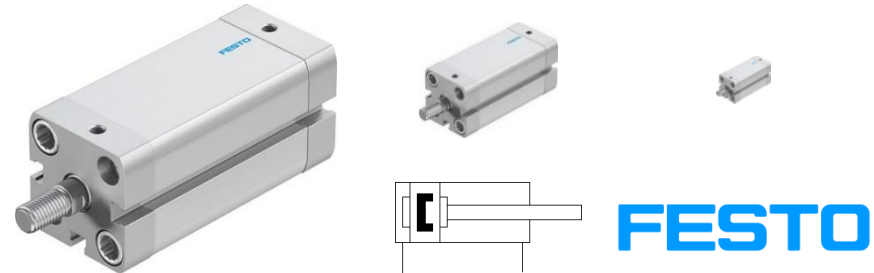
Application example



```
ADN-25-50-A-P-A (Role: AutomationComponent)
├── Geometry (Role: COLLADAGeometryModel)
│   ├── Geometry-Interfaces
│   │   └── COLLADAInterface (Class: COLLADAInterface)
│   └── AutomationMLComponentStandardRCL/COLLADAGeometryModel
├── Kinematics (Role: COLLADAKinematicAttachment)
│   ├── Kinematics-Interfaces
│   │   └── COLLADAInterface (Class: COLLADAInterface)
│   └── Rod (Role: COLLADAKinematicAttachment)
│       ├── Rod-Interfaces
│       │   ├── COLLADAInterface (Class: COLLADAInterface)
│       │   └── AttachmentInterface (Class: AttachmentInterface)
│       └── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
├── Base (Role: COLLADAKinematicAttachment)
│   ├── Base-Interfaces
│   │   ├── COLLADAInterface (Class: COLLADAInterface)
│   │   └── AttachmentInterface (Class: AttachmentInterface)
│   └── SensorSlot1 (Role: COLLADAKinematicAttachment)
│       ├── SensorSlot1-Interfaces
│       │   ├── COLLADAInterface (Class: COLLADAInterface)
│       │   └── AttachmentInterface (Class: AttachmentInterface)
│       └── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
├── SensorSlot2 (Role: COLLADAKinematicAttachment)
│   ├── SensorSlot2-Interfaces
│   │   ├── COLLADAInterface (Class: COLLADAInterface)
│   │   └── AttachmentInterface (Class: AttachmentInterface)
│   └── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
├── SensorSlot3 (Role: COLLADAKinematicAttachment)
│   ├── SensorSlot3-Interfaces
│   │   ├── COLLADAInterface (Class: COLLADAInterface)
│   │   └── AttachmentInterface (Class: AttachmentInterface)
│   └── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
└── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
├── Joint_RodBase (Role: COLLADAKinematicJoint)
│   ├── Joint_RodBase-Interfaces
│   │   ├── COLLADAInterface (Class: COLLADAInterface)
│   │   └── JointInterface (Class: JointInterface)
│   └── AutomationMLComponentStandardRCL/COLLADAKinematicJoint
└── AutomationMLComponentStandardRCL/COLLADAKinematicAttachment
```

Application example of pneumatic cylinder 1/2

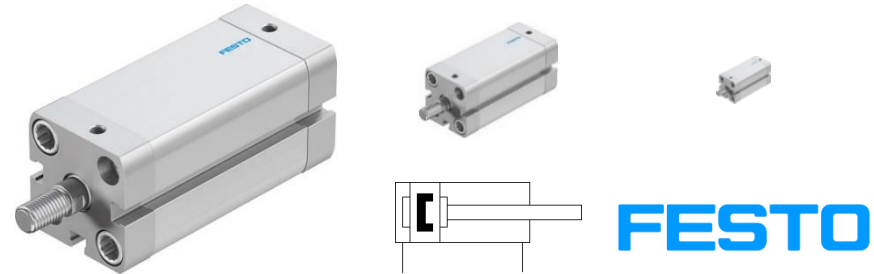
- General data
 - Data sheet attributes for identification
- External data
 - Picture, icon and pneumatic symbol of the component and a manufacturer logo
 - Documentation of the component
 - Simplified logical behavior model with link to the corresponding AMLLogic document
- Model information
 - Geometry and kinematics models with link to the corresponding COLLADA document










Name	Typ	Größe
5AAC1504024E495EAE90B7051E953D26	JPG-Datei	16 KB
5AAC1504024E495EAE90B7051E953D26_32x32	Symbol	4 KB
320px-Festo_logo.svg	PNG-Datei	3 KB
536258_ADN-25-50-A-P-A%20_previewAttachments.dae	DAE-Datei	145 KB
00991217	PNG-Datei	1 KB
ADN_EN	Adobe Acrobat Document	1.250 KB
CAEX_ClassModel_V2.15	W3C XML Schema	30 KB

Application example of pneumatic cylinder 2/2

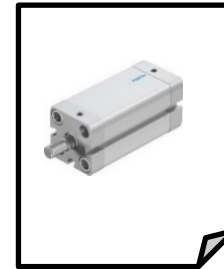
- Connectors
 - Mechanical connections for piston rod, base body and sensor slots of the component
 - Pneumatic connectors of the component
- Multiple relations (internal links) between kinematic and behavioral model and connectors



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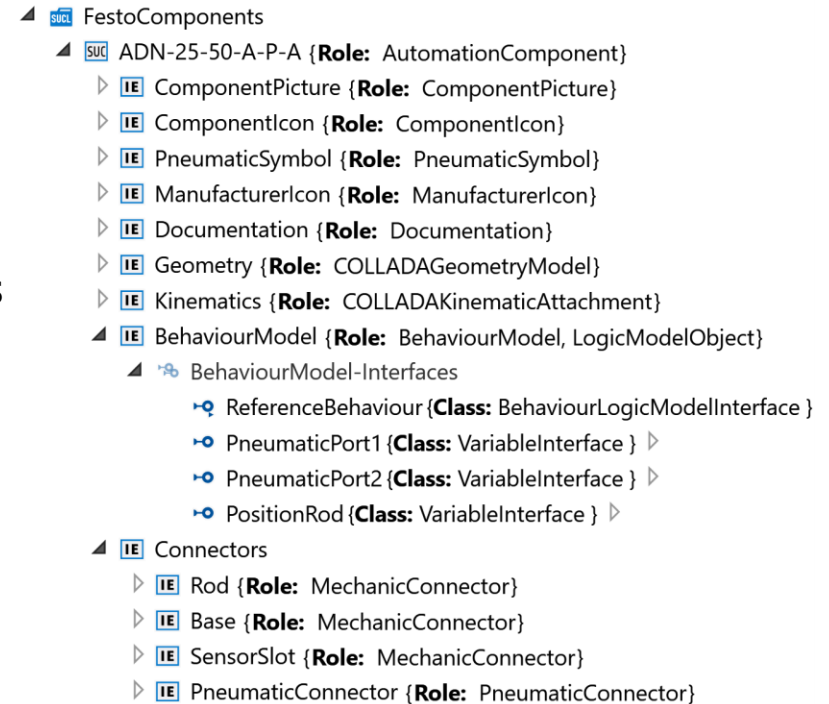
- Integration is done via an ExternalInterface from the ICL "AutomationMLComponentBaseICL".
- Interface is a child element of an InternalElement with a role class from the RCL "AutomationMLComponentBaseRCL" or "AutomationMLComponentStandardRCL".

```
└─ [SRC] ADN-25-50-A-P-A {Role: AutomationComponent}
  └─ [IE] ComponentPicture {Role: ComponentPicture}
    └─ [ComponentPicture-Interfaces]
      └─ [GraphicRepresentationReference {Class: GraphicRepresentationReference}]
        └─ [RR] AutomationMLComponentStandardRCL/ComponentPicture
          └─ [IE] ComponentIcon {Role: ComponentIcon}
            └─ [IE] ManufacturerIcon {Role: ManufacturerIcon}
              └─ [IE] PneumaticSymbol {Role: PneumaticSymbol}
                └─ [SRC] AutomationMLComponentStandardRCL/AutomationComponent
```

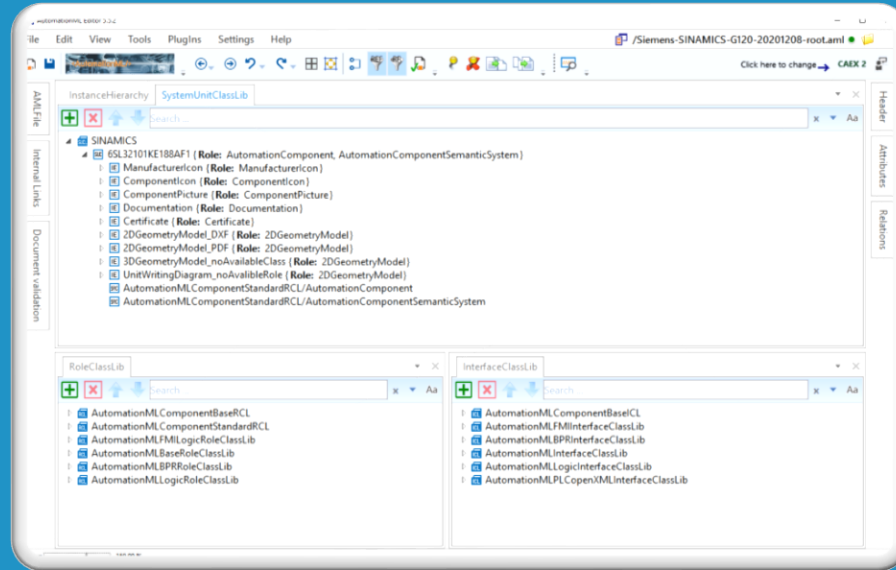


PNG

- Cylinder was modeled as SystemUnitClass
- Attributes are attached to the SUC
- For each model aspect a separate IE was created and the corresponding models were referenced
- Connectors were modeled as IE with ExternalInterfaces
- Relations were linked



Let's do it



Thank you for your attention

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