AutomationML describing Components for Virtual Commissioning

Dr. Wolfgang Schloegl
Head of Digital Engineering
Siemens AG, Nuremberg, Germany

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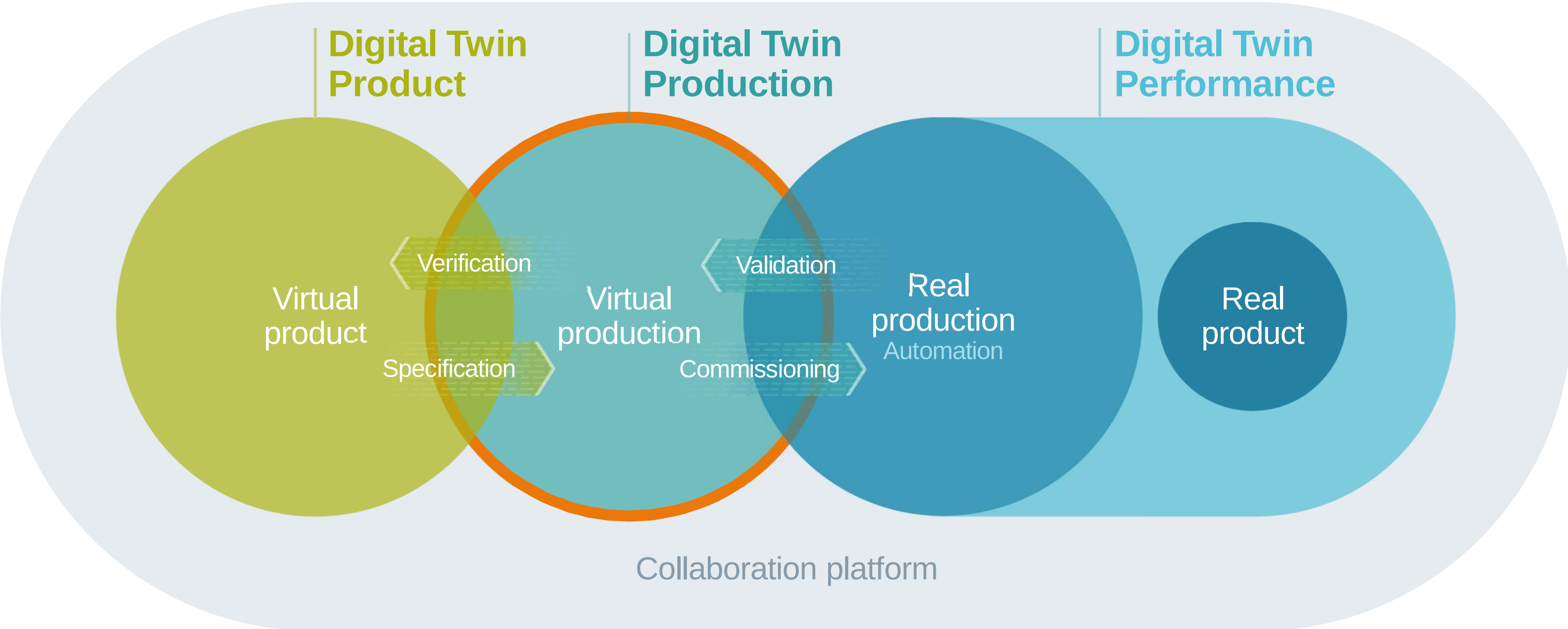
Holistic Digital Twin for Manufacturing



Engineering and Simulation based on the Digital Twin

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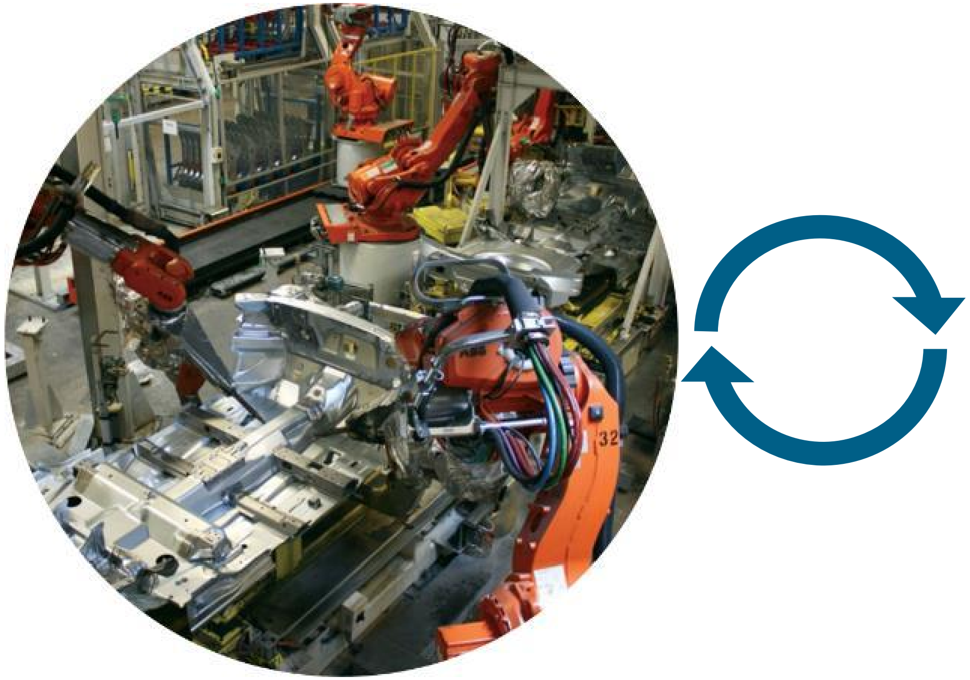
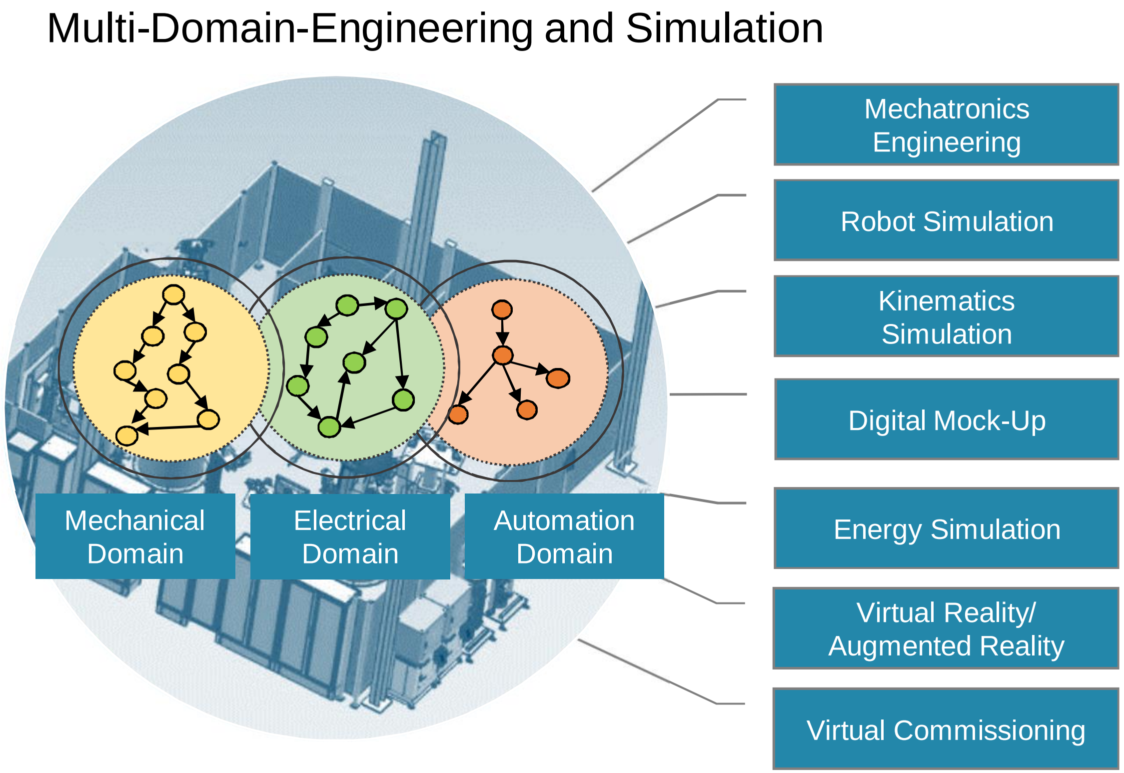
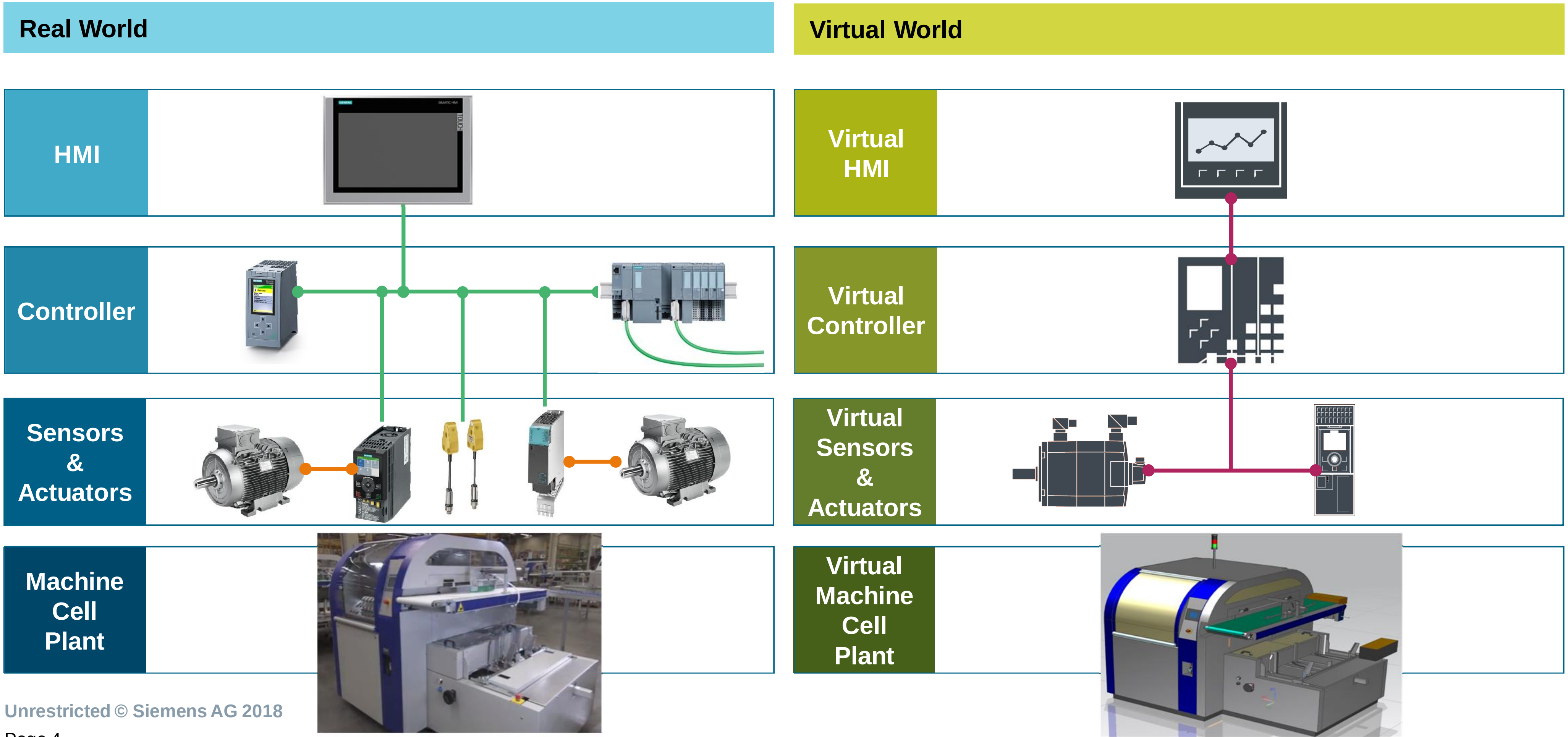


Real Production



Digital Twin

Simulation at every Level



Data needed for Simulation and Virtual Commissioning – Availability of automatically interpretable Data

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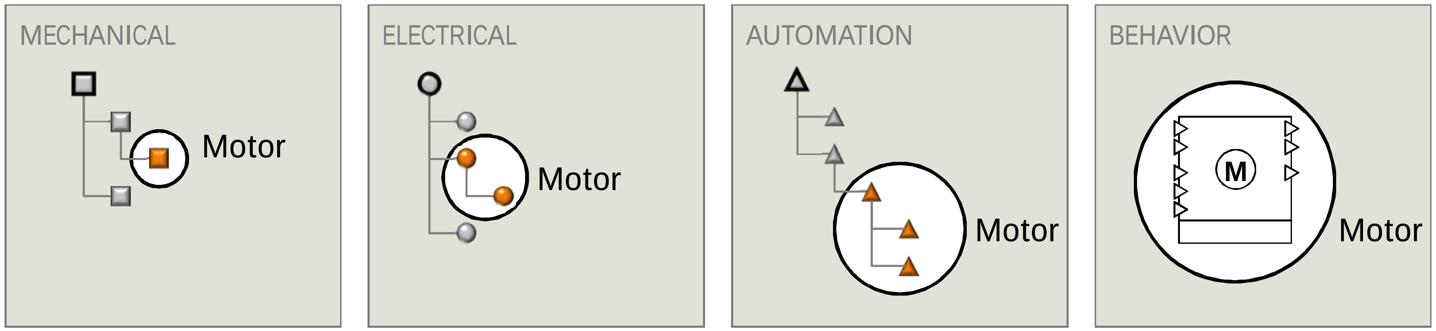
Crucial for Virtual Commissioning

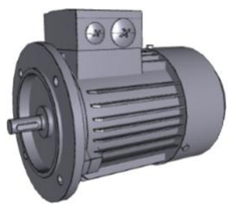


e.g.: JT file

e.g.: E-CAD template

e.g.: PLC function block

No tool independent automatically interpretable data available



Library Content for Virtual Commissioning

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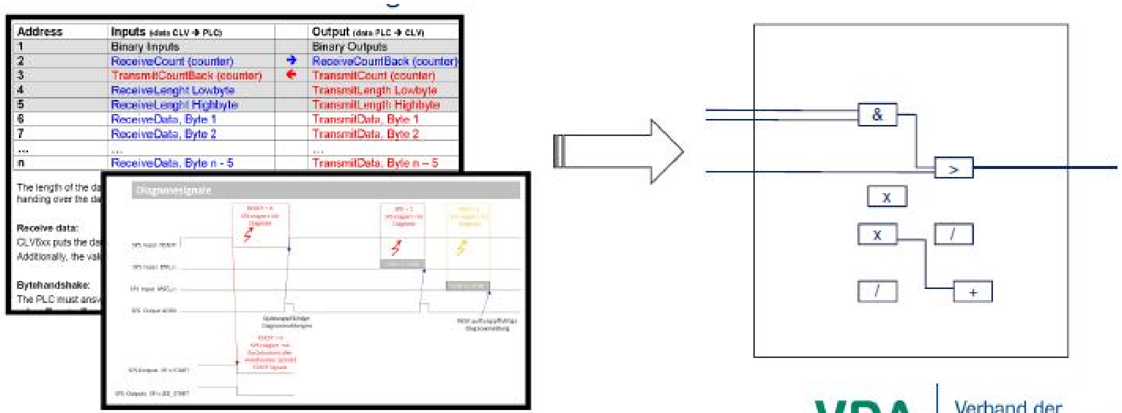
Example Library of Behavior Models:

Cluster	Components	Complexity
Operator panels	6	Low
Safety devices	9	Low
Drives	55	High
Conveyors	11	High
Robot interfaces	7	Very high
Circuit breakers	10	Low
Part presence controls	11	Low
Special functions	11	High
Total	**120**	

Challenge today:

Manual modelling based on written device documentation (interface documentation, function diagrams, …) or reverse engineering.



VDA Verband der Automobilindustrie

Goal: Definition of a neutral format describing the behavior of electrical devices containing function elements that can be interpreted automatically.

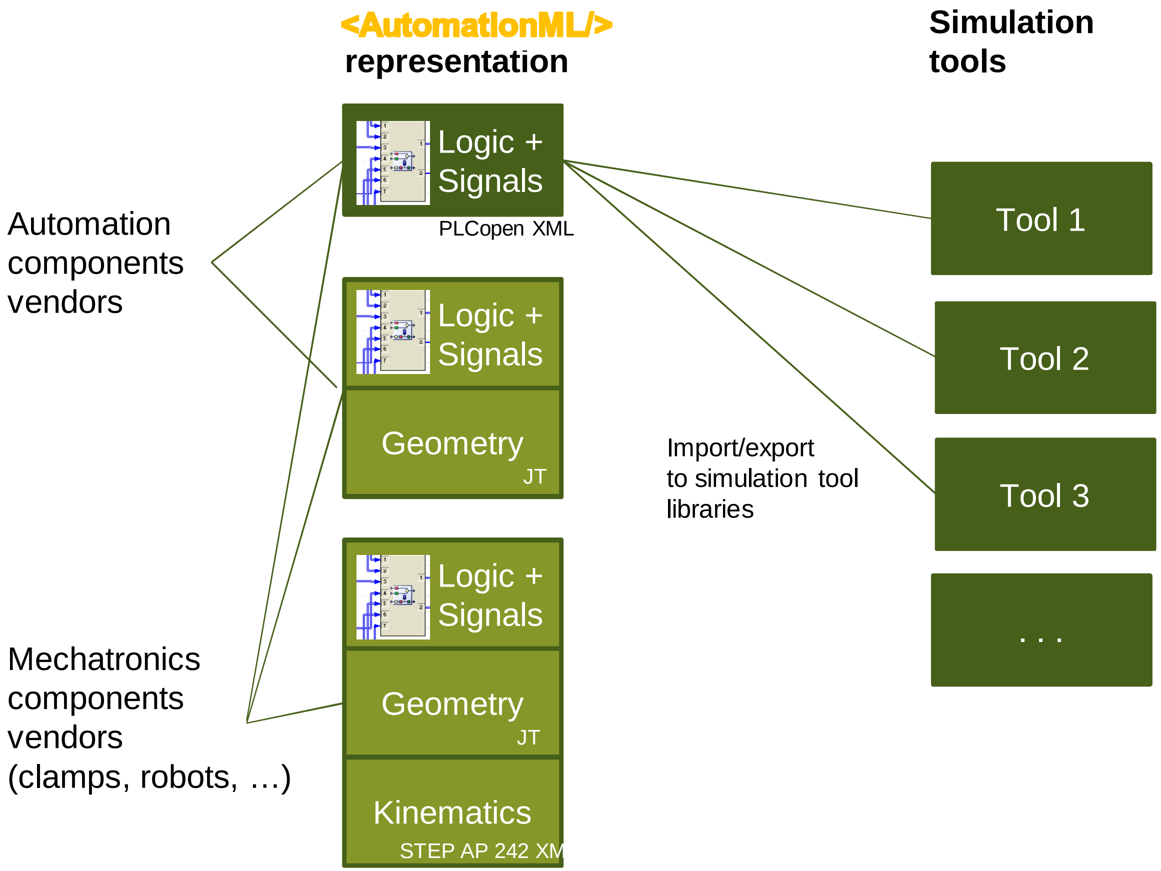
AutomationML for describing Mechatronics Components for Virtual Commissioning

Initial Situation

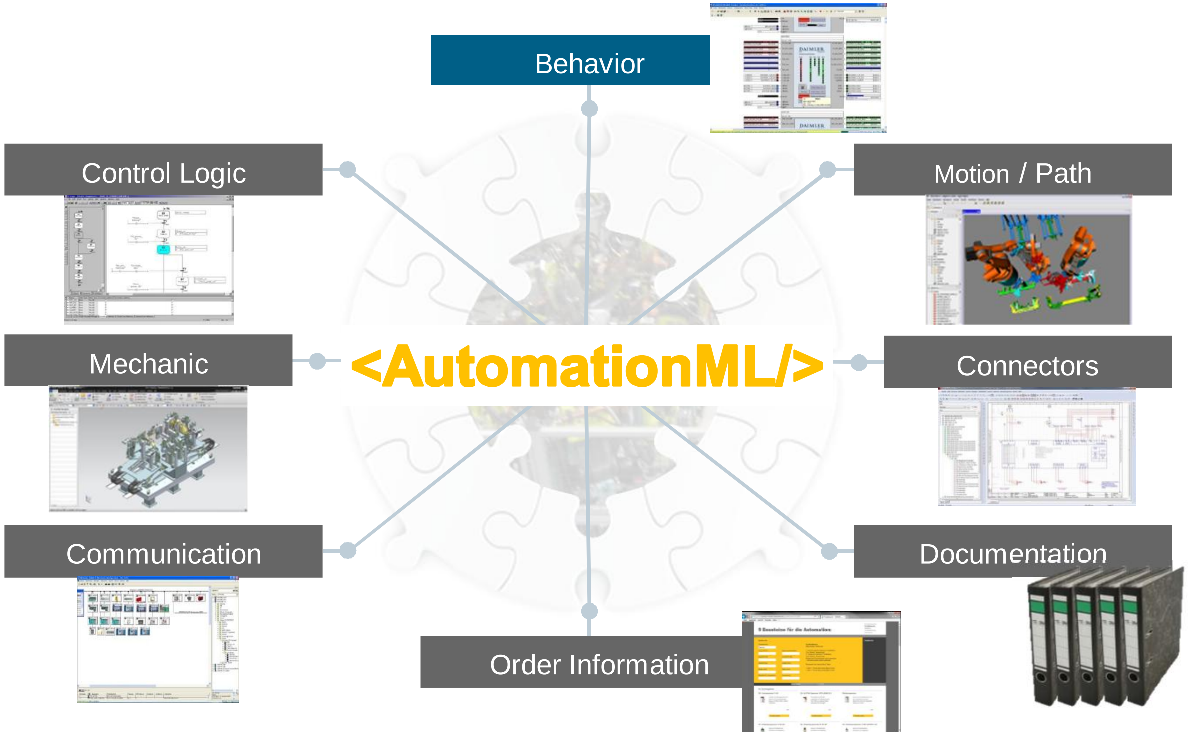
- High effort to create libraries of behavior models for every device for every simulation system at every user based on paper documentation
- The component manufacturers have the knowledge about their component's behavior
- The behavior models are developed differently by each user based on its knowledge, the target systems and the use-case
- Reverse-engineering needed occasionally because of insufficient documentation

Goal

Usage of AutomationML to create a standard for describing mechatronics components for virtual commissioning



Aspects of Automation Components



Automation components combine different aspects of information

- General data
  - Ordering information
  - Technical information
  - Documentation of the automation component
  - Symbols and pictures.
- Functional data
  - Information to describe the functional behavior of the automation component.
  - Function blocks to control the component
  - Internal interlocking of the automation component
- Model information
  - Simulation Model
  - 2D and 3D models
  - Kinematic models
- Connectors to all logic, electric, pneumatic and hydraulic interfaces of the component

Example: Motor

Classification

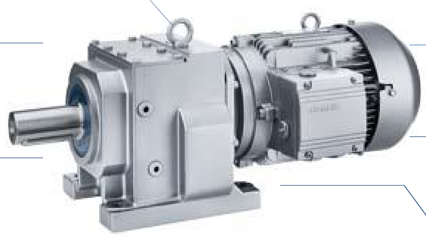
eCl@ss classification

Behavior Model (PLCOpenXML)

- Logic
- Signals
- …

Graphical Data

- Product pictures
- 2D/ 3D-Data
- Icons



Technical Data

- Technical attributes
- Values

Documentation

- Catalogue
- Manuals
- Specifications
- Certificates

Commercial Data

- Price
- Product Number
- Order Number

Example: Motor

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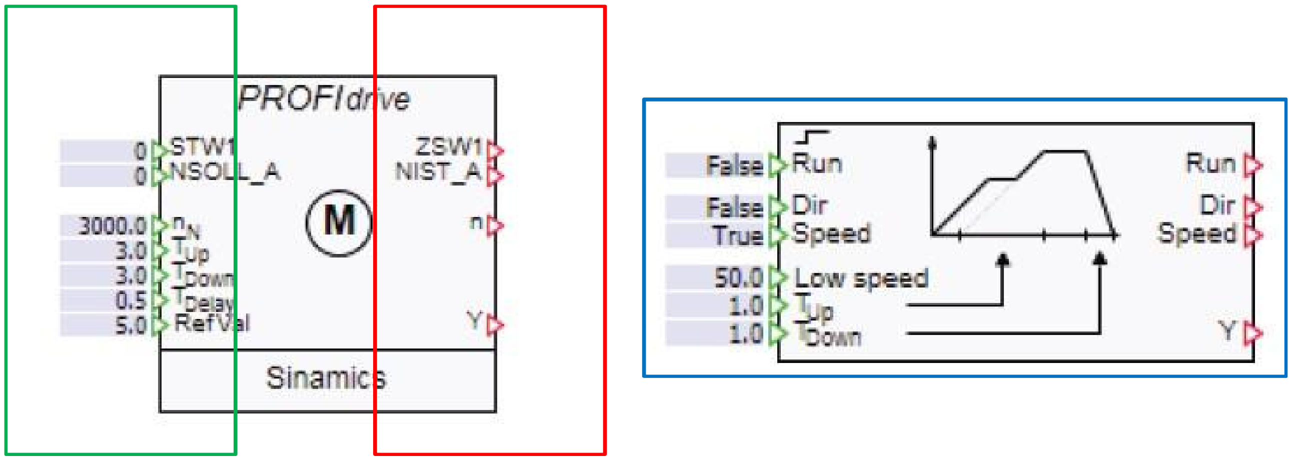
The behavior model of a motor

Input Connectors
Output Connectors
Model (PLCOpen XML)



Automation Components in AutomationML: Example Motor

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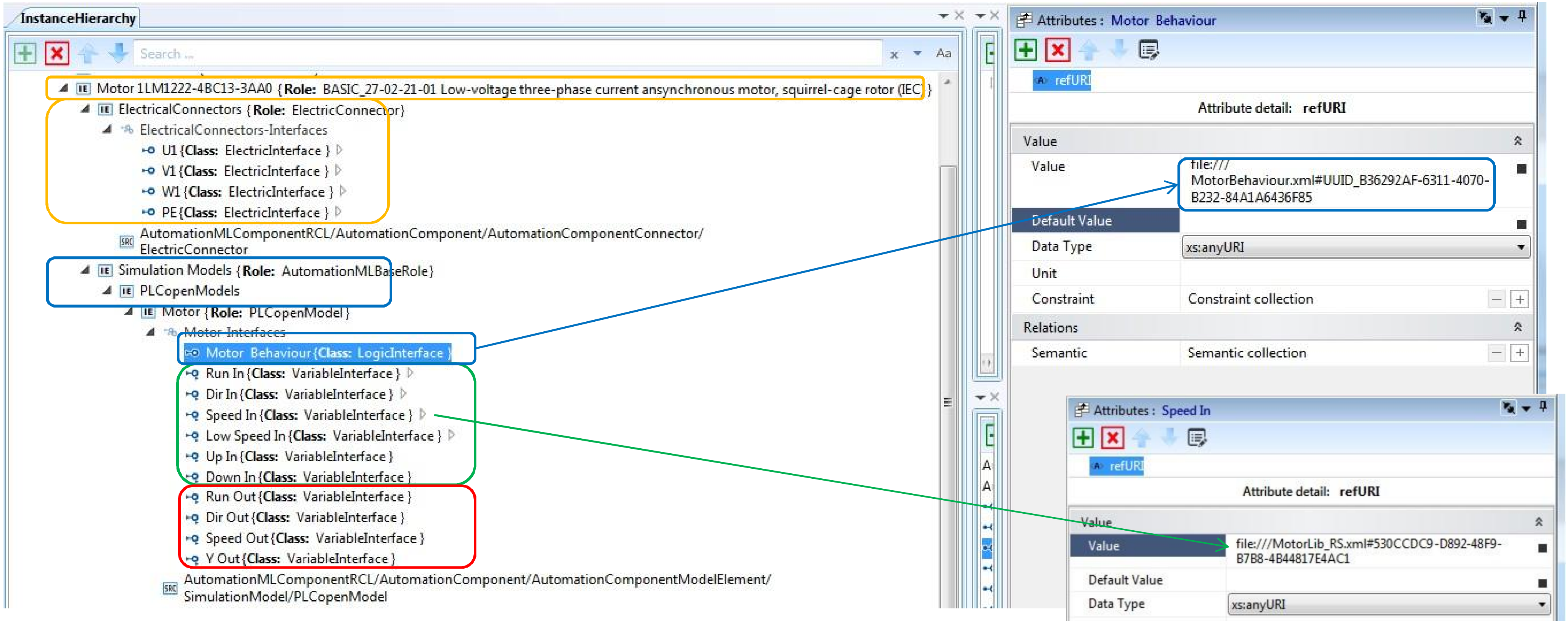

Example: Frequency Converter

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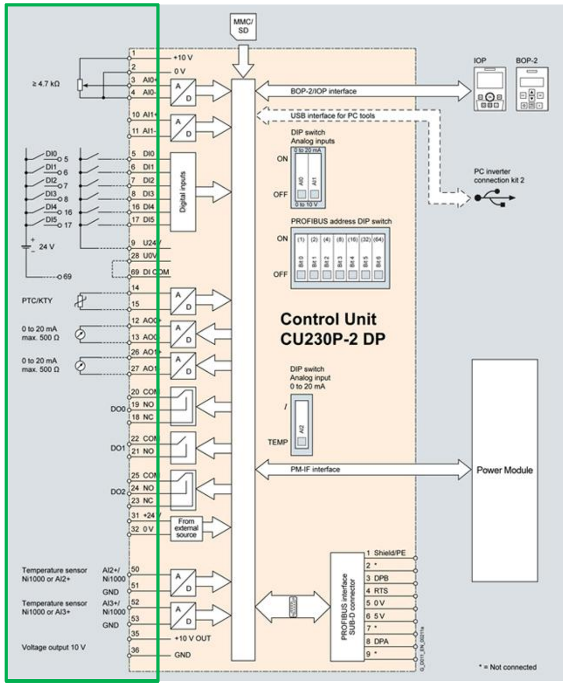
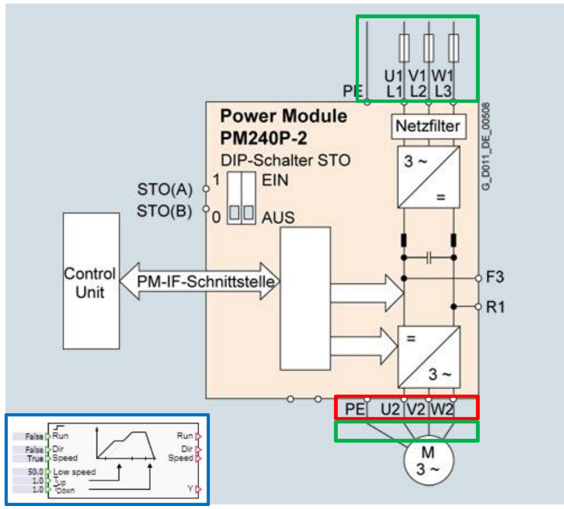
The motor in combination with a frequency converter





Input Connectors
Output Connectors
Model (PLCOpen XML)

Example Motor and Frequency Converter: Electrical connection

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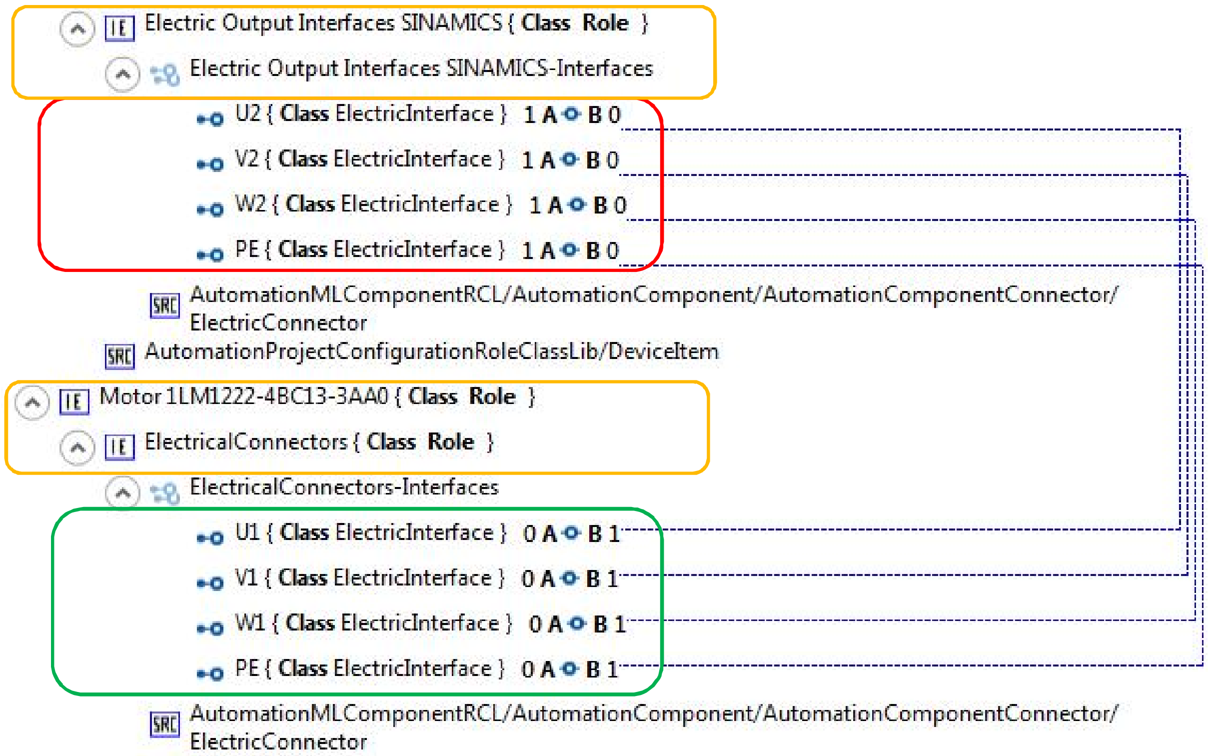
The electric output connectors of the frequency converter are connected to the input connectors of the motor



Example Motor and Frequency Converter: Connection to PLC

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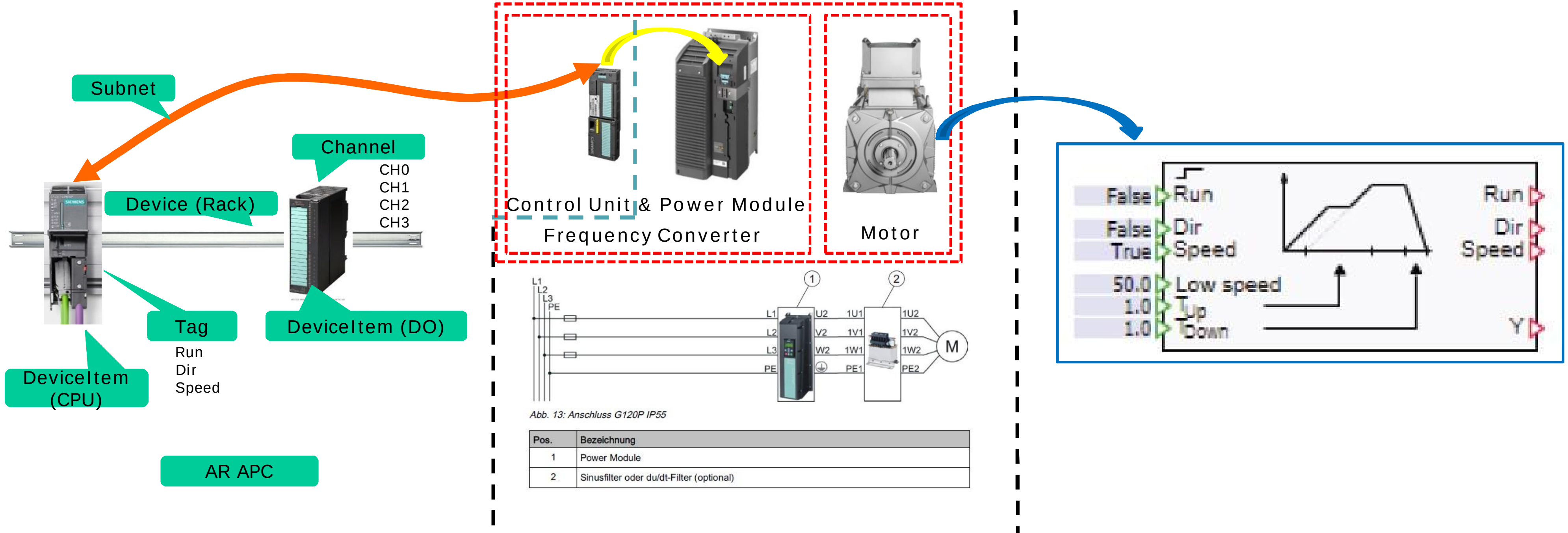
Connect the PLC to the motor and to the frequency converter according AR APC



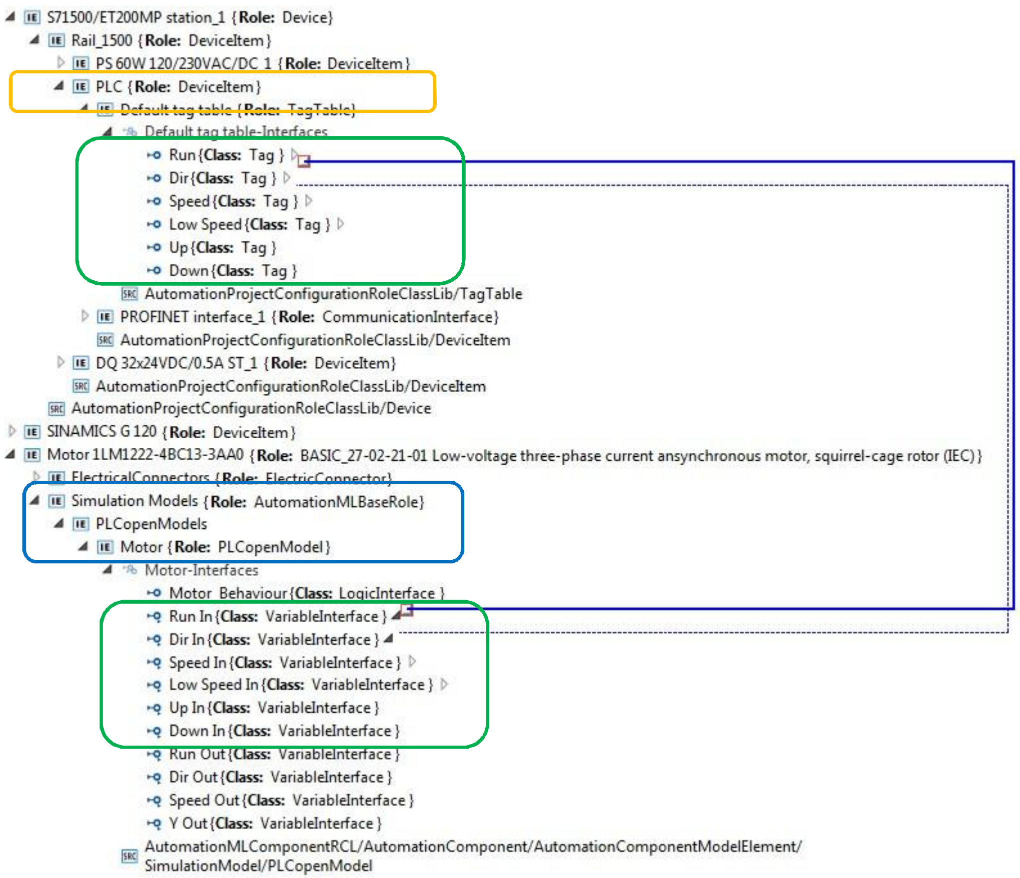
PLC World: Logical connection

Electrical World: Electrical connection

Simulation World: Behavior (PLCOpen XML)

Example Motor and Frequency Converter: Connection to PLC

The connection of the simulation to the PLC according AR APC in AutomationML



AutomationML describing Components for Virtual Commissioning - Outlook

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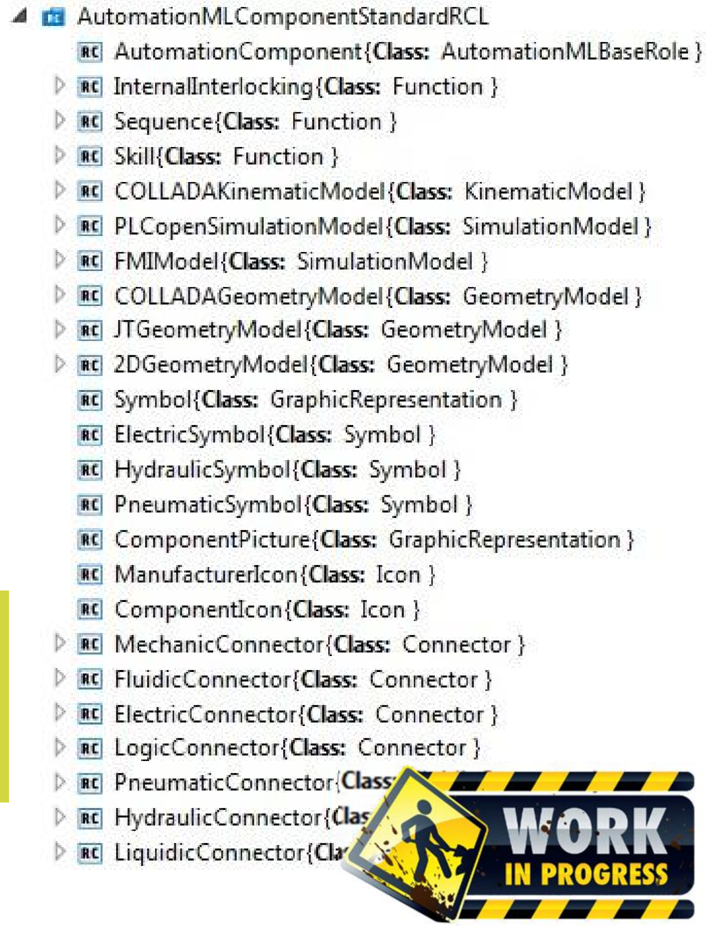
Beside the shown AutomationML behavior description based on PLCOpen XML further aspects of components are about to be defined:

- FMI models (higher accuracy, knowledge protection)
- Vendor specific simulation models
- Collada Kinematic Models
- JT Geometry
- 2DGeometry Models
- Electric, fluidic, hydraulic
- . . .

Together with 3D, kinematics and electrical data the shown concept allows the definition of mechatronics building blocks for the digital twin of production in an AutomationML-based standardized component model.



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Make AutomationML yours!
Thank you.

schloegl.wolfgang@siemens.com