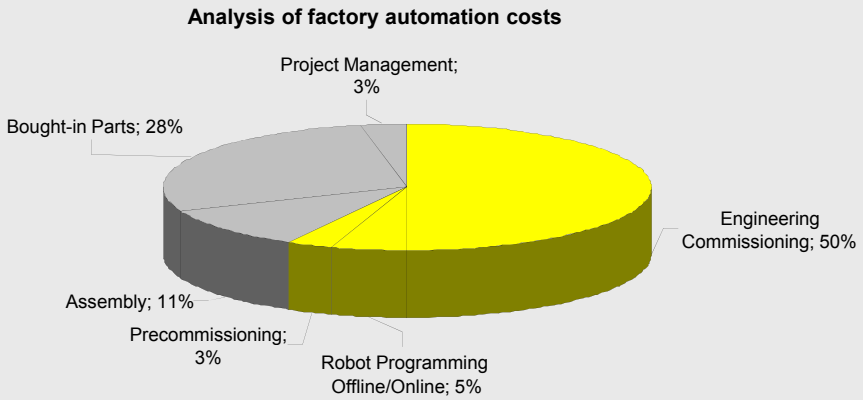
Quo Vadis AutomationML

Past, present, and future
of the data exchange format

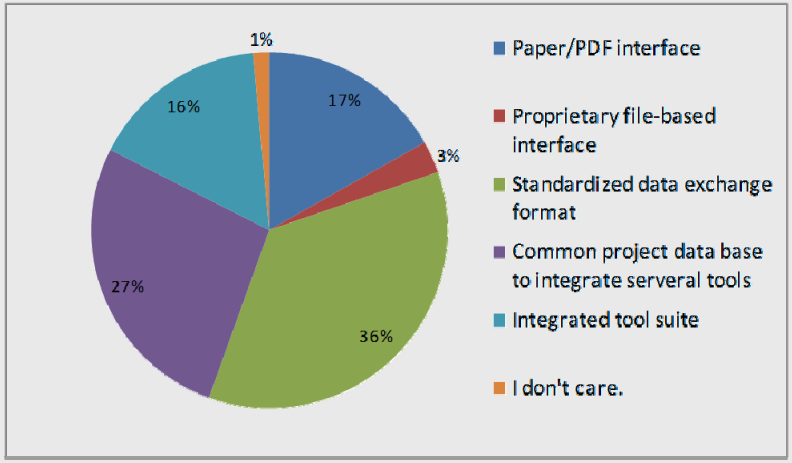
The Past

- **Human labor for engineering is an important cost driver**
- **One part of human activities is data exchange between engineering tools which shall be automated**
  - Reduce human intervention
  - Reduce human caused errors and time expenses

➔ **What is an appropriate data exchange technology for the engineering of production systems and its involved control systems?**



Source: Cost structure analysis for robotic and control technology, AIDA 2005



Source: Expectations of practitioners to data exchange technologies, OvGU 2014

The Past
Initial aims of AutomationML

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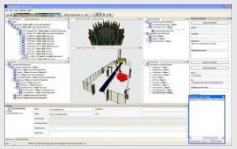
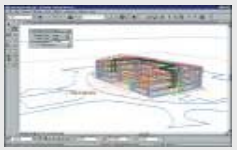
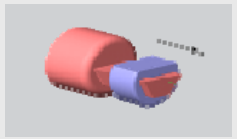
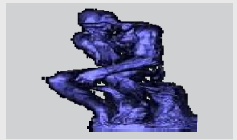
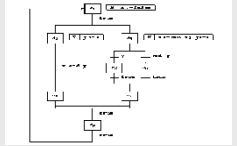
The Glue for Seamless Automation Engineering

- *Topology*
- *Geometry*
- *Kinematics*
- *Path planning*
- *Logic/Behaviour*
- *…*

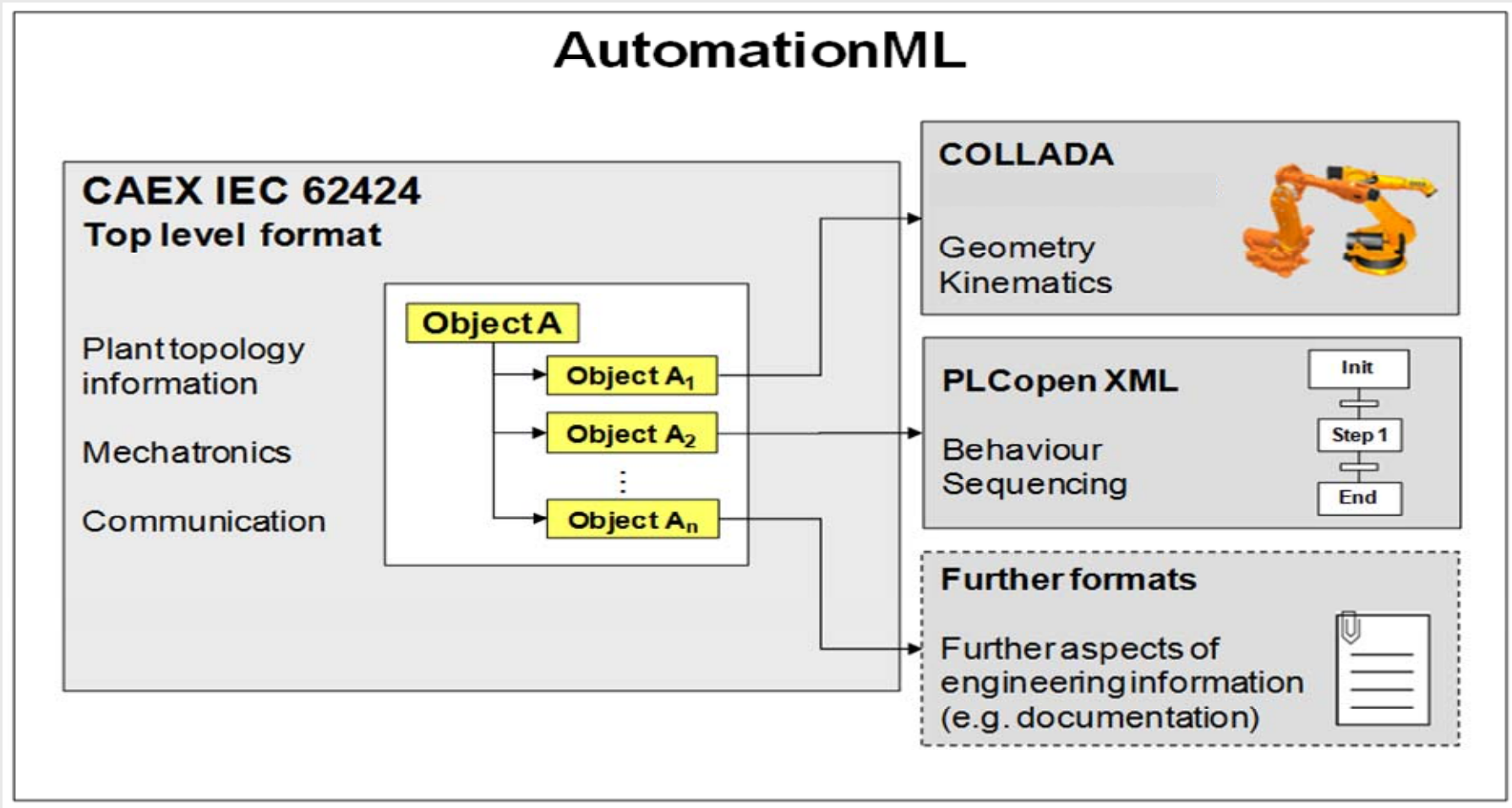







The Present AutomationML Architecture



The Present AutomationML Architecture

The Present
Graph based structures

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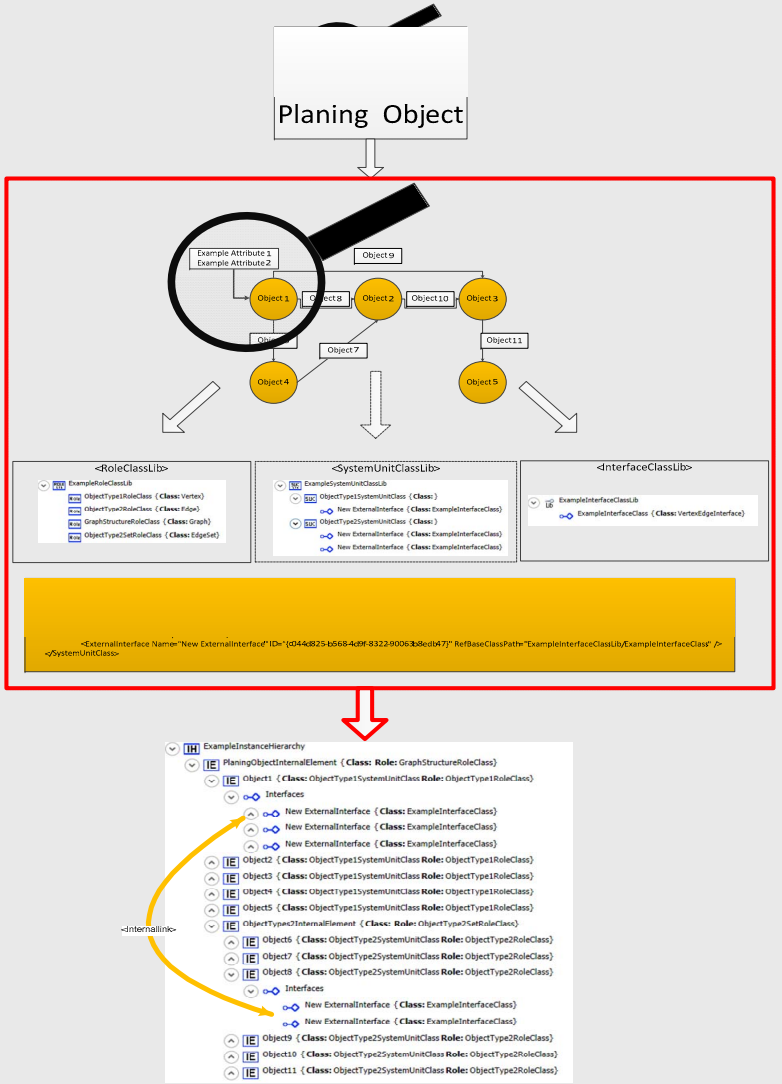
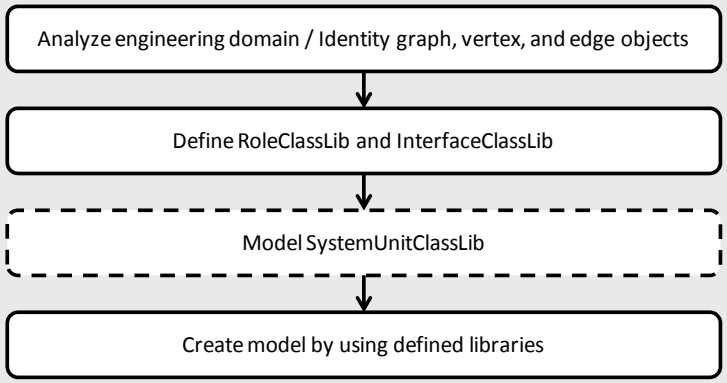
- **Creation of a Best Practice Recommendation about modeling of graph based structures by AutomationML**
  - Harmonization of similar approaches
  - First used for communication systems, applicable also for HW config, electrical wiring, piping, …
  - Contains application process and basic roles / interfaces





The Present
Information and processes recently covert

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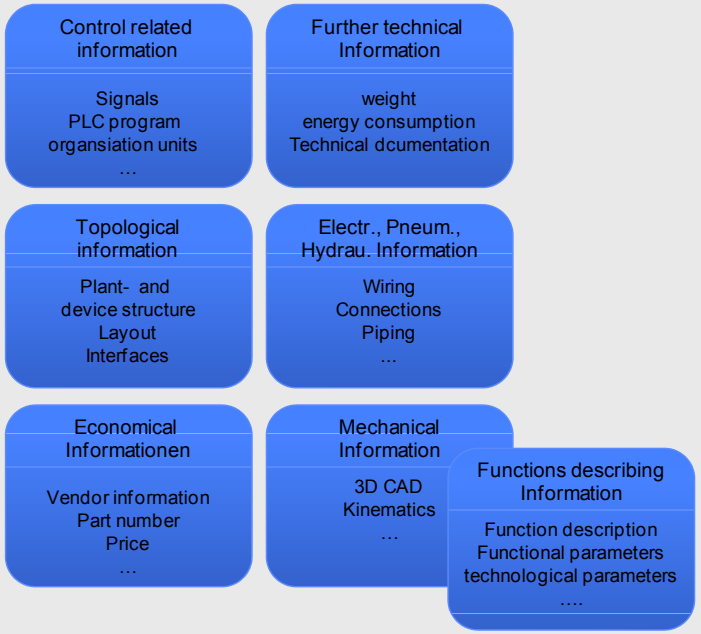
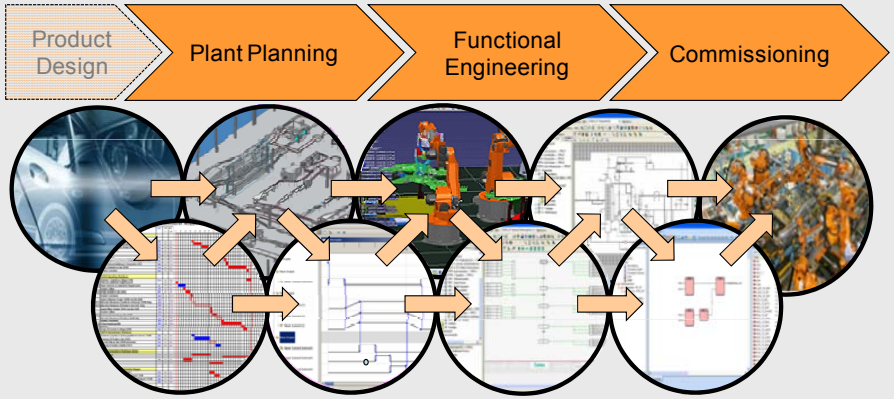
- **Covered information**
  - Plant topology, geometry and kinematics for e.g. robot cell programming and simulation
  - Behaviour models for plant components
  - Plant component properties
    - Economics
    - Process related
    - ...
  - Network structures of plant components
- **Covered processes**
  - Information exchange within engineering process life cycle from general plant planning to virtual commissioning





The Present Standardisation

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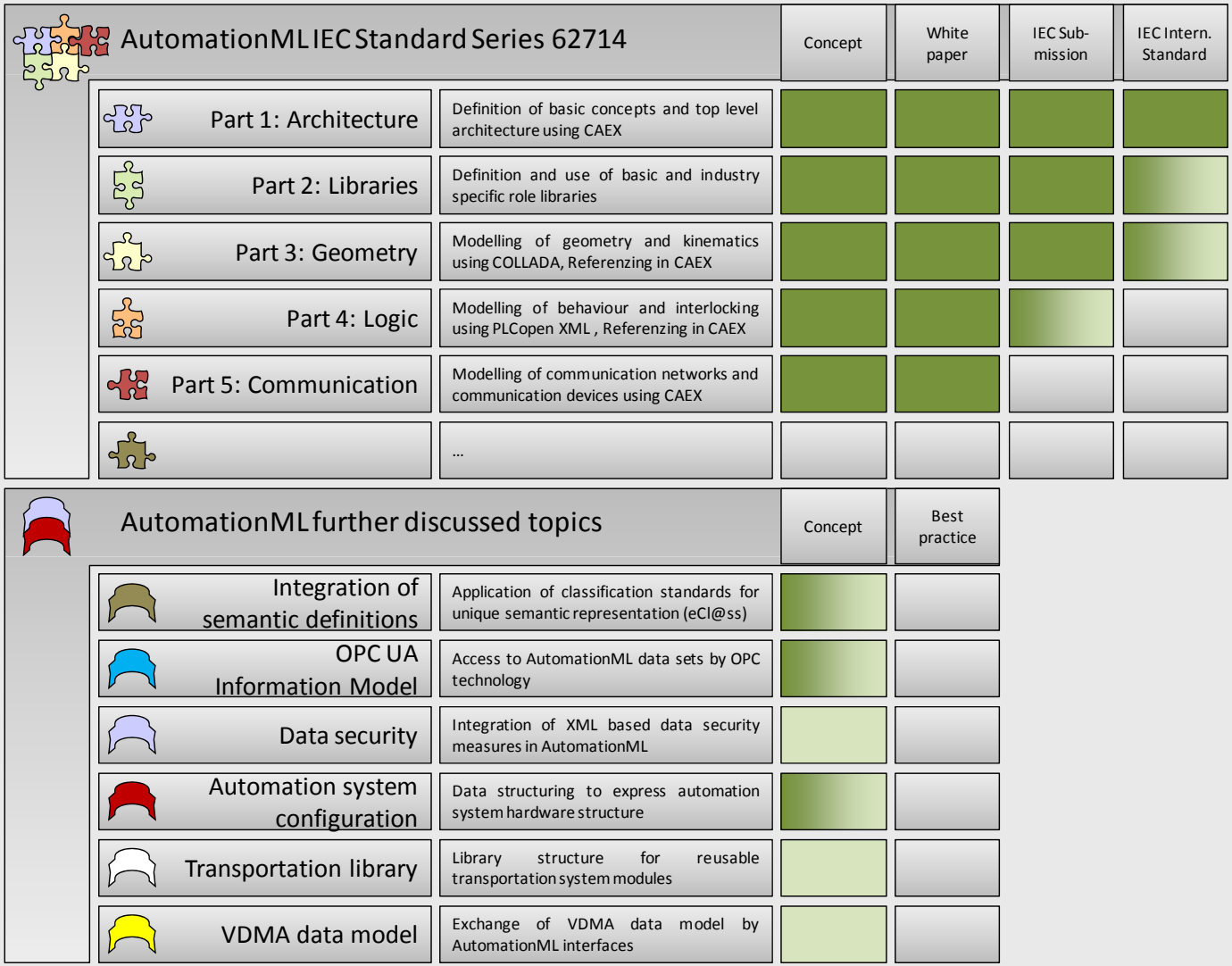

The Present
Implementation highlights

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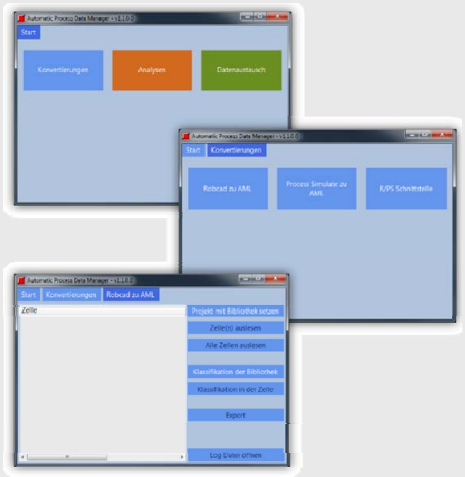
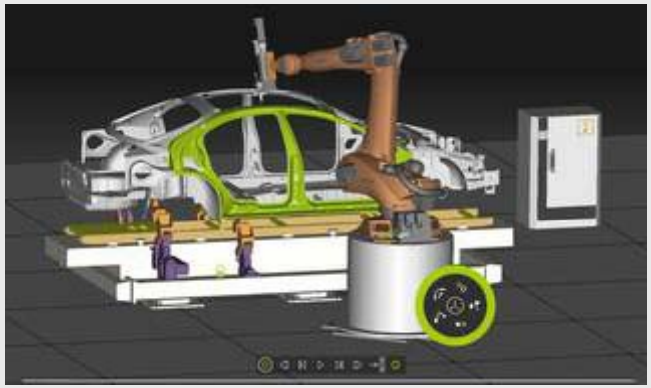
- **Automatic Process Data Manager of West GmbH**
  - Export of simulation relevant data from SIEMENS PLM Robcad and Process Simulate
  - Used within virtual commissioning framework ROBSIM from EKS InTec
  - Practically used for example at Audi



Source: www.west-gmbh.com/files/content/WEST_APDM_AutomationML_2014.pdf

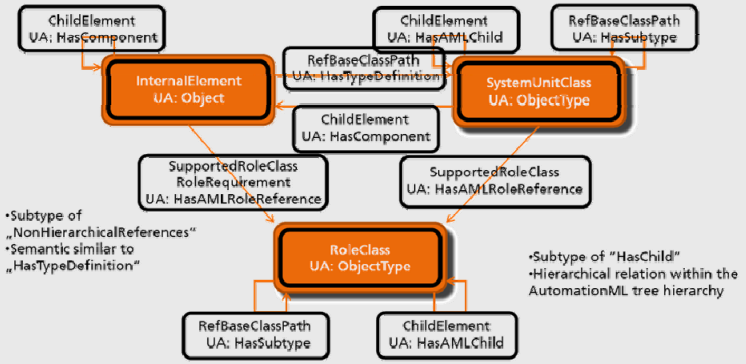
- **FASTSUITE Edition 2 from CENIT AG**
  - AutomationML based interface for layout information exchange
  - Use of digital factory tools to build, program, validate, and optimize production environment
  - Compatible to ROBSIM



Source: www.cenit.com/en_EN/plm/digital-factory/software/fastsuite-edition-2.html

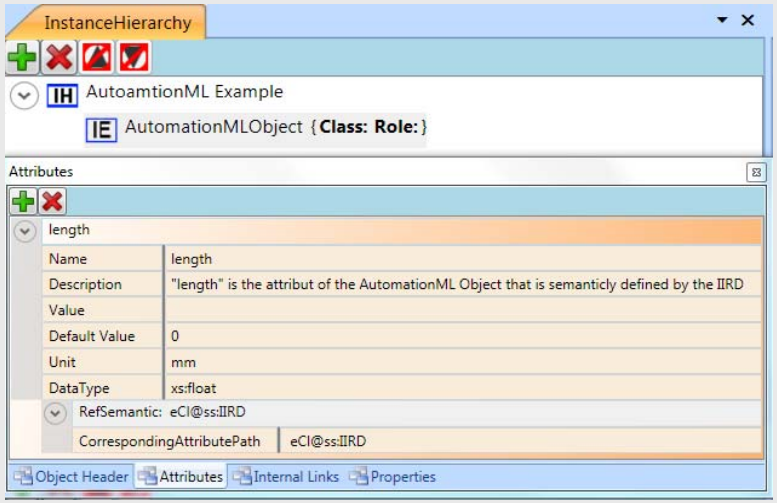
The Future
Started activities

- **OPC UA Information Model**
  - Mapping of AutomationML data structure to OPC UA data model
  - Definition of integration process
  - Identification of application scenarios



Source: Fraunhofer IOSB Karlsruhe

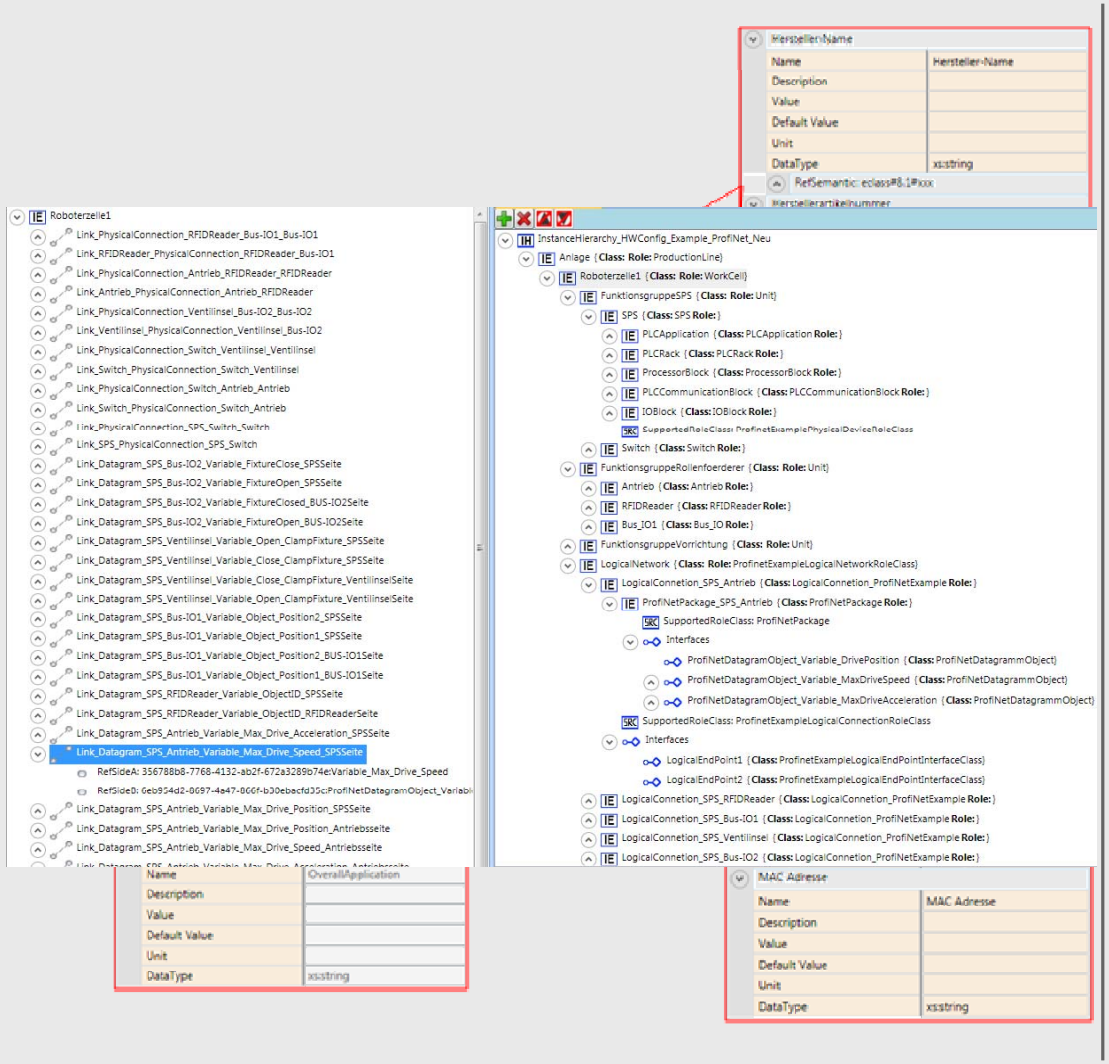
- **Integration of semantic definitions**
  - Definition of two levels of semantic integration
    - Specify object and attribute semantic
    - Create eCl@ss plain role library
  - Identification of application scenarios



Source: INPRO Berlin

The Future
Started activities

- **Automation system configuration**
  - Modelling of hardware configuration of control systems including
    - Device hierarchy / topology
    - Structure of control application including variable declaration
    - Physical wiring
    - Logical connections as identification of exchanged variables
  - Definition of a kind of application profile



The Future
Running research projects (selection)

- **ReApp**
  - Tool chain for intelligent robot programming capable to auto-matically build the skeleton of or the complete control programs

- **AVANTI**
  - Test methodology for virtual commissioning based on behaviour simulation of production systems

- **EfA**
  - Methods, tools and solutions in order to the explicitly acquire and monitor requirements and to validate variants of control applications

- **Conexing**
  - Tool for discipline crossing planning and product related virtual optimization of automated production systems

- **For more projects visit www.automationml.org**

The Future Industrie 4.0

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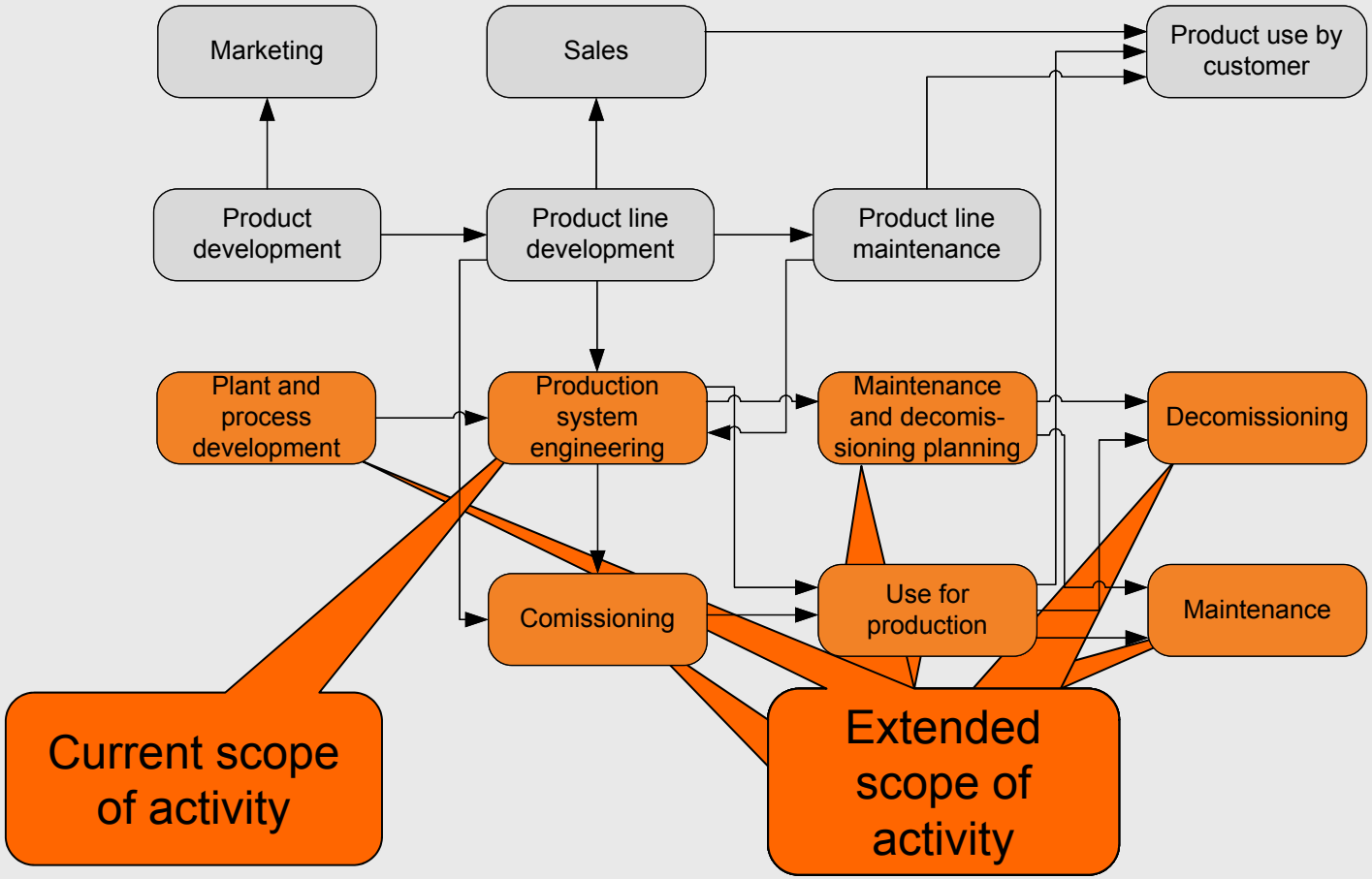
The Glue for Seamless Automation Engineering

- **Current mega trend in Germany**
- **Aims:**
  - Integration of advanced IT capabilities like Internet of Things and Services, Cloud computing, and Big Data within industrial information processing on all layers of control
  - Ensure horizontal integration along value chain networks, vertical integration within networked production systems, and consistent digital engineering along the engineering chains
  - Improve production system flexibility and adaptability
- **Coordinated by Industrie 4.0 platform (a joint activity of VDMA, ZVEI, and BITKOM)**
- **Industrie 4.0 platform currently considers existing data exchange formats and its usability as a bundle**

- **Focus of Industrie 4.0 is on engineering and use of products and production systems**



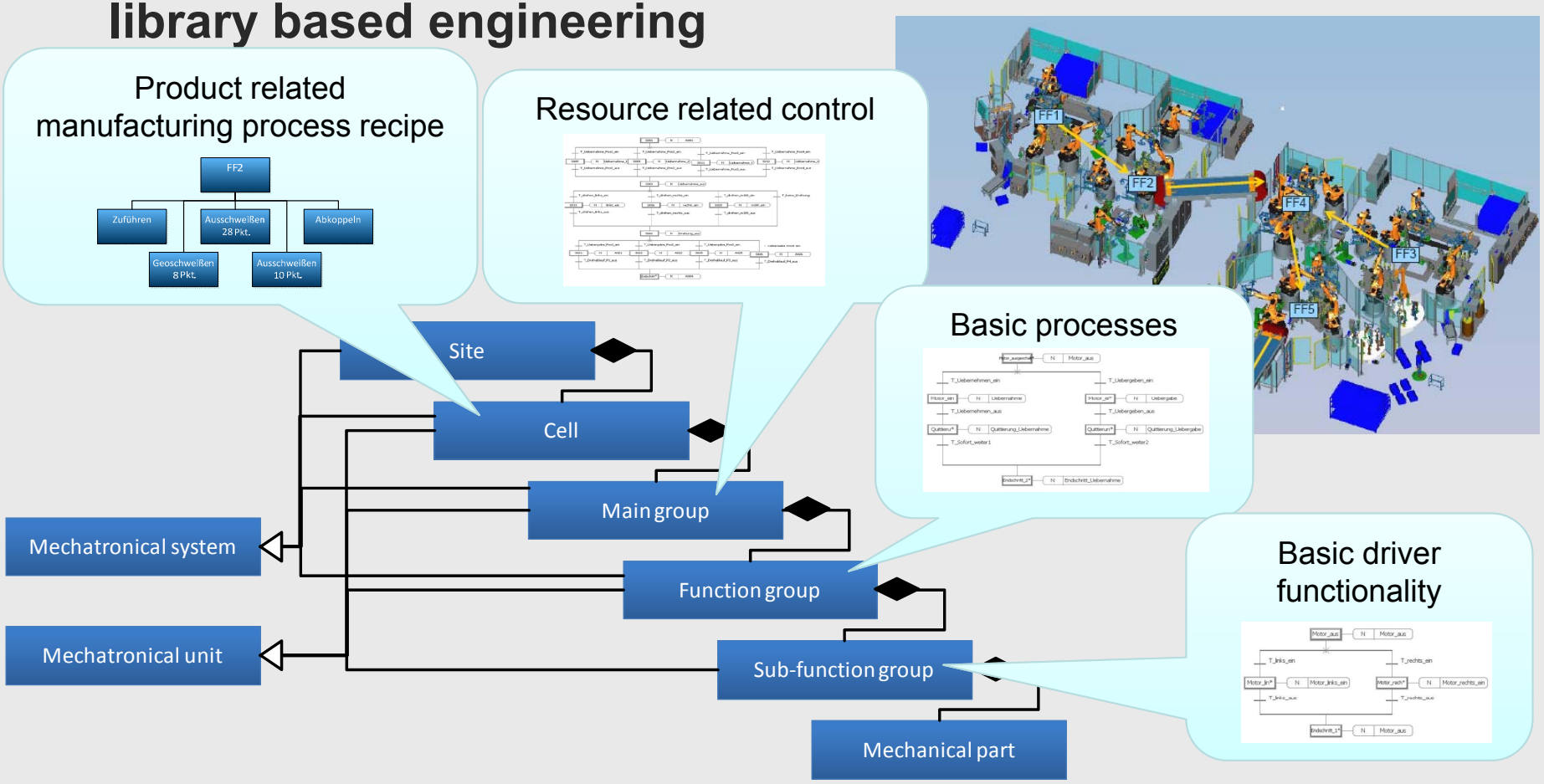
The Future Industrie 4.0

- **AutomationML can be exploited to**
  - Model Industrie 4.0 components as mechatronic objects including structure and behavior modeling to enable library based engineering
  - Model process descriptions both as required and provided processes to enable automatic resource selection within flexible production
  - Provide semantically enriched information during runtime of production system
  - …

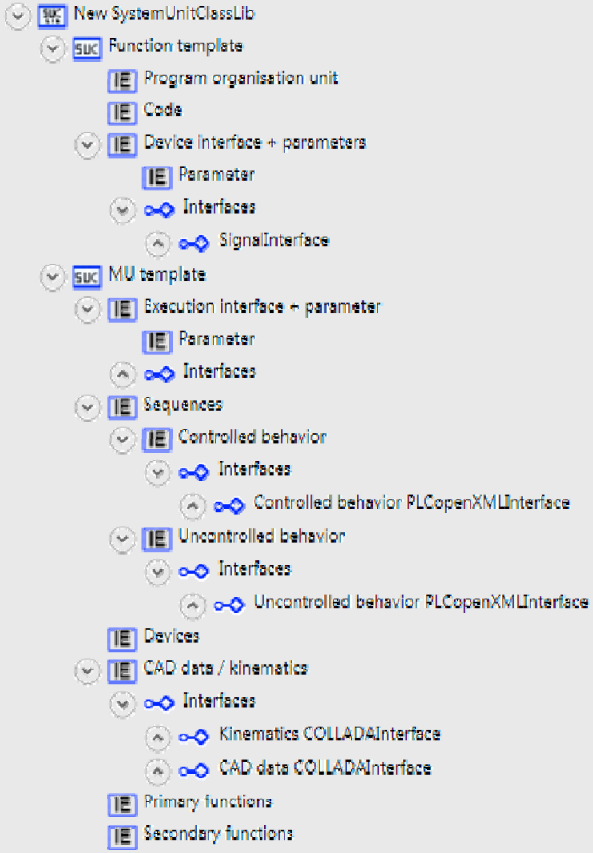
- **To be Industrie 4.0 enables**
  - Enable process descriptions following PPR model structure
  - Enable semantic integration
  - Ensure compatibility to other relevant standards
  - …

The Future Industrie 4.0

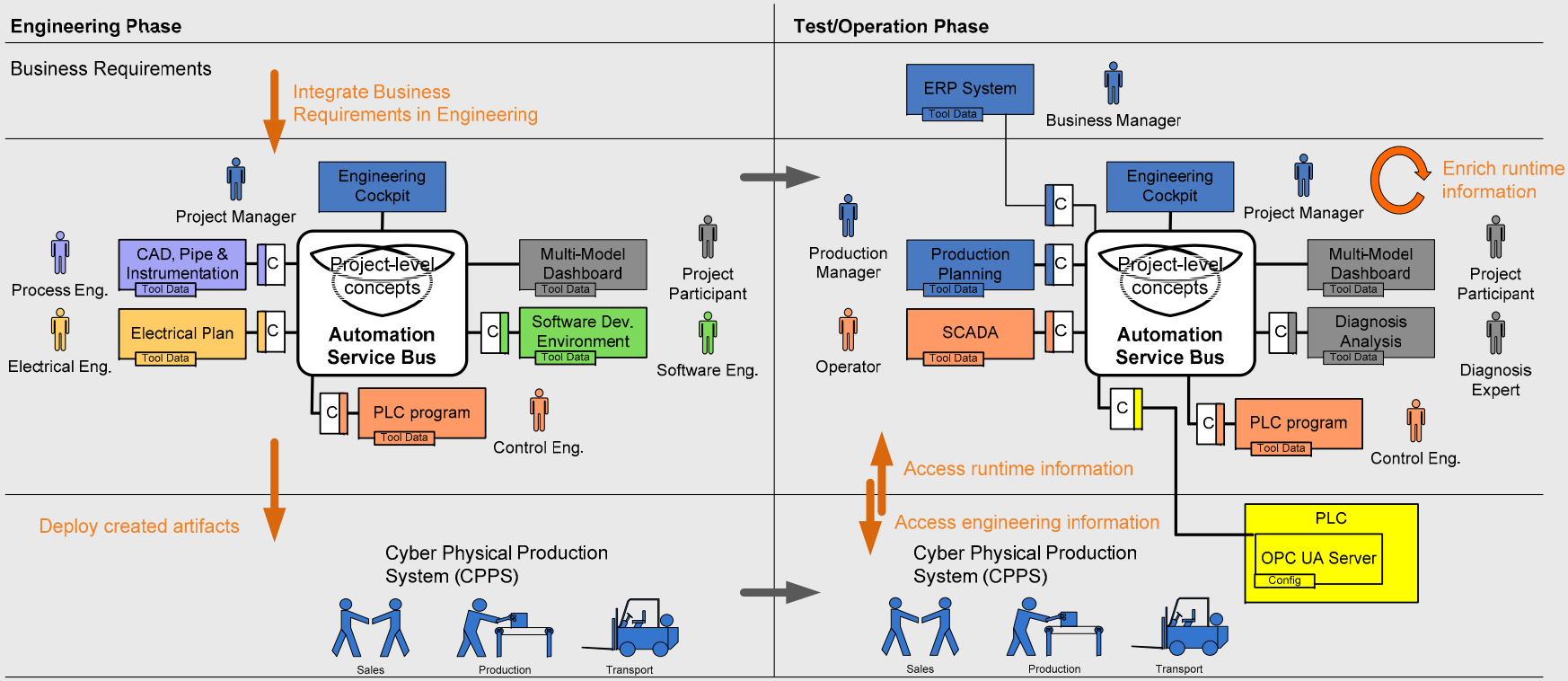
- **Model Industrie 4.0 components as mechatronic objects including structure and behavior modeling to enable library based engineering**



- **Model Industrie 4.0 components as mechatronic objects including structure and behavior modeling to enable library based engineering**



- **Provide semantically enriched information during runtime of production system**



"Pour ce qui est de l'avenir, il ne s'agit pas de le prévoir, mais de le rendre possible. "

"Die Zukunft soll man nicht voraussehen wollen, sondern möglich machen.“

Antoine de Saint-Exupéry