

The background of the top banner features a blue-tinted image of industrial automation. On the left, a robotic arm is visible. In the center, there's a complex mechanical assembly. On the right, a control panel with a screen and buttons is shown. The overall theme is industrial engineering and automation.

<AutomationML/>

The Glue for Seamless
Automation Engineering

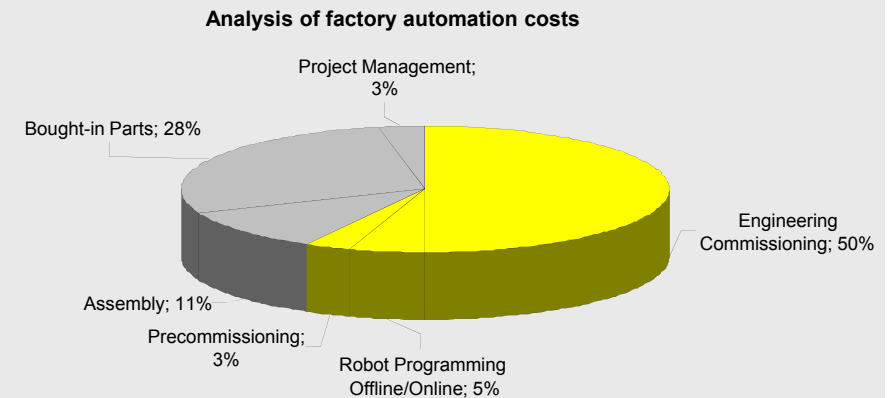
Quo Vadis AutomationML

Past, present, and future
of the data exchange format

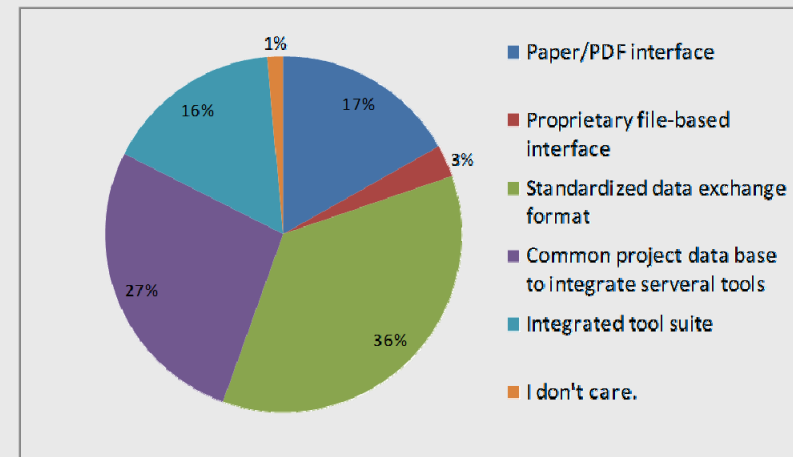
The Past

- 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

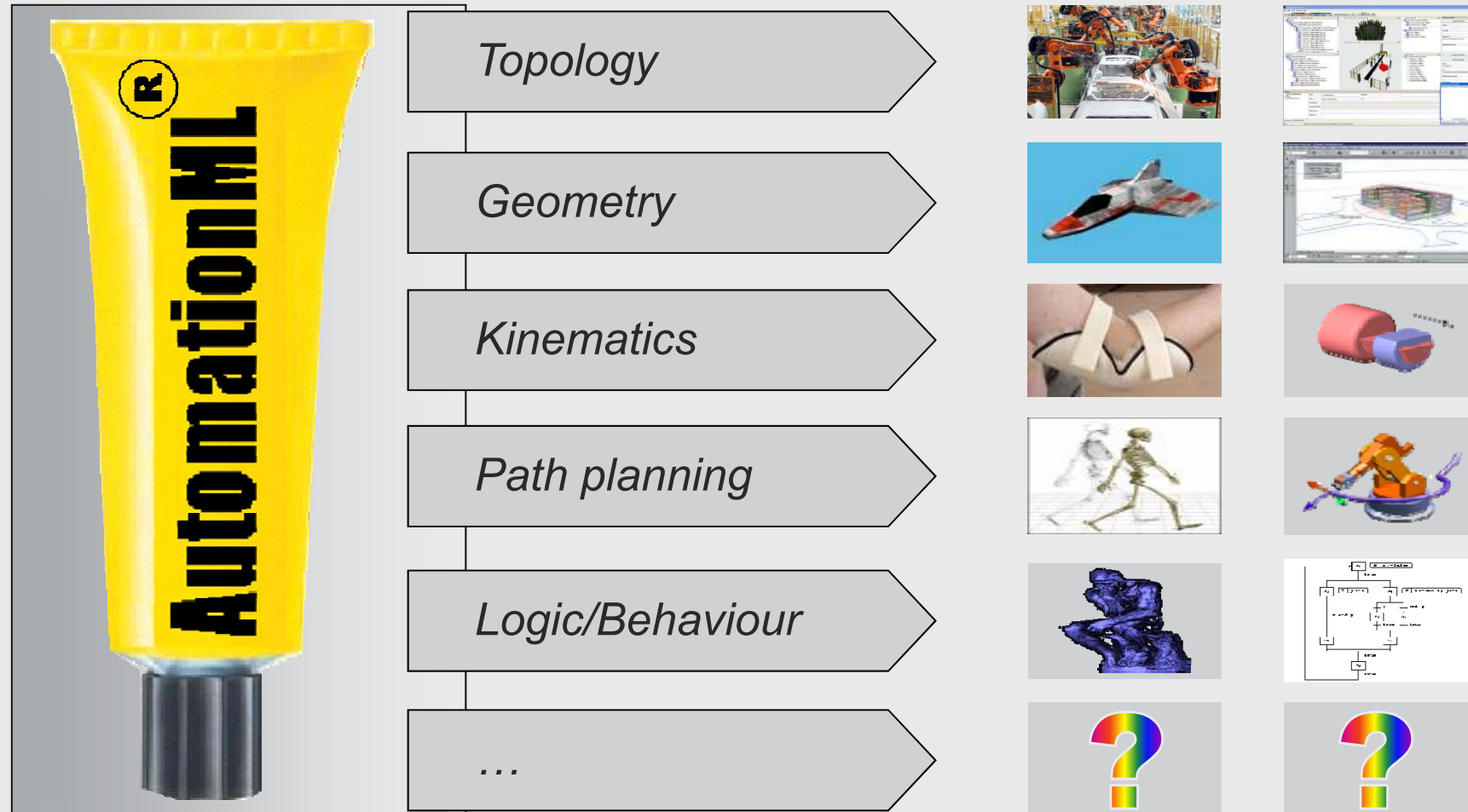


Source: Expectations of practitioners to data exchange technologies, OvGU 2014

The Past

Initial aims of AutomationML

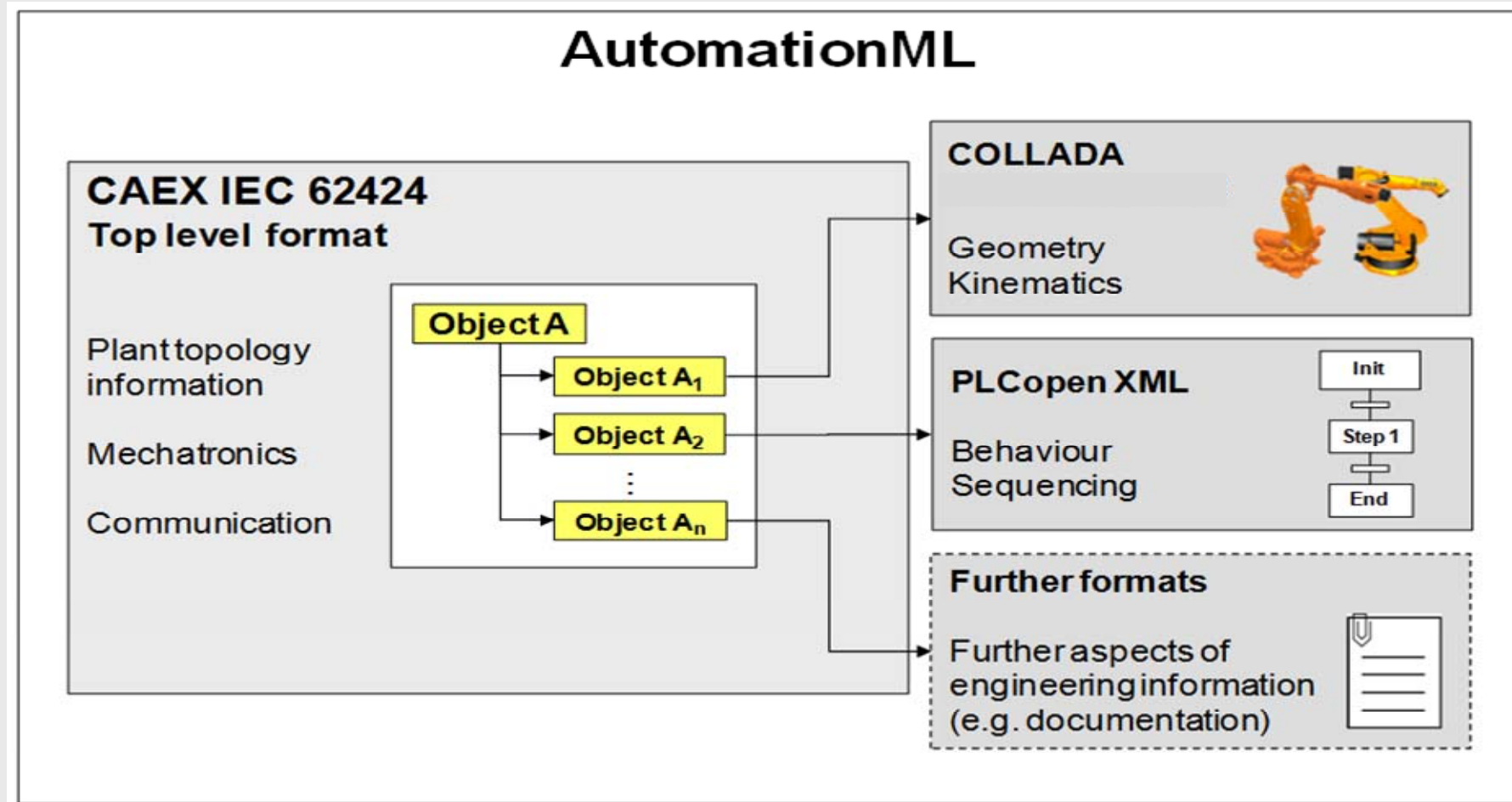
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The Present AutomationML Architecture

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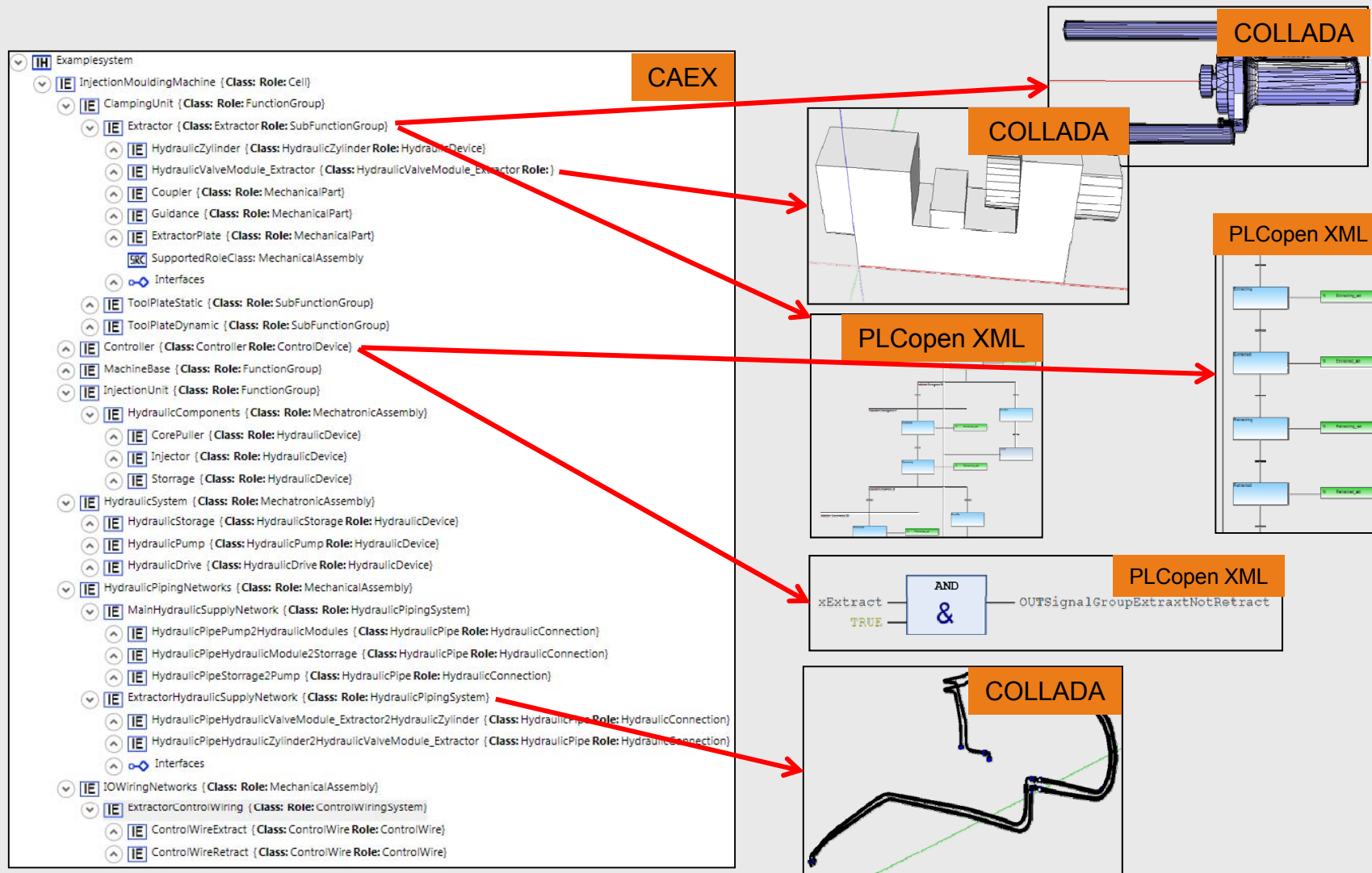
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The Present AutomationML Architecture

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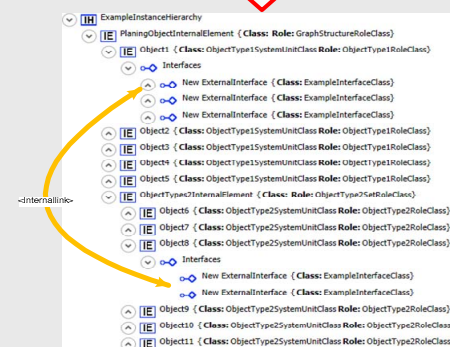
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-
- Planing Object
- Object 1 (circled with magnifying glass)
- Object 2, Object 3, Object 4, Object 5, Object 7, Object 8, Object 9, Object 10, Object 11
- <RoleClassLib>
- ExampleRoleClassLib
 - Object1pelRoleClass (Class: Vertex)
 - Object1pelRoleClass (Class: Vdp)
 - GraphStructureRoleClass (Class: Graph)
 - Object1pel2stRoleClass (Class: EdgeSet)
- <SystemUnitClassLib>
- ExampleSystemUnitClassLib
 - Object1pelSystemUnitClass (Class:)
 - New ExternalInterface (Class: ExampleInterfaceClass)
 - Object1pel2stSystemUnitClass (Class:)
 - New ExternalInterface (Class: ExampleInterfaceClass)
 - New ExternalInterface (Class: ExampleInterfaceClass)
- <InterfaceClassLib>
- ExampleInterfaceClassLib
 - ExampleInterfaceClass (Class: VertexEdgeInterface)
- <ExternalInterface Name="New ExternalInterface" ID="{0C44825-b668-4d9f-8322-900638ed4877}" RefBaseClassPath="ExampleInterfaceClassLib\ExampleInterfaceClass" />
 <SystemUnitClassLib>



The Present Information and processes recently covert

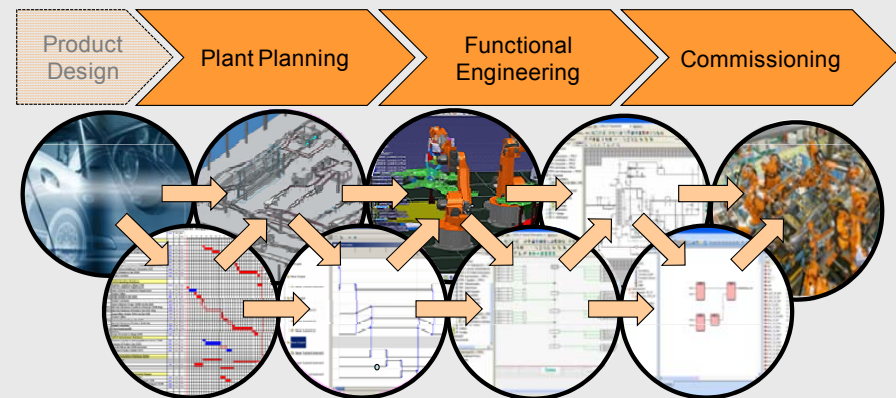
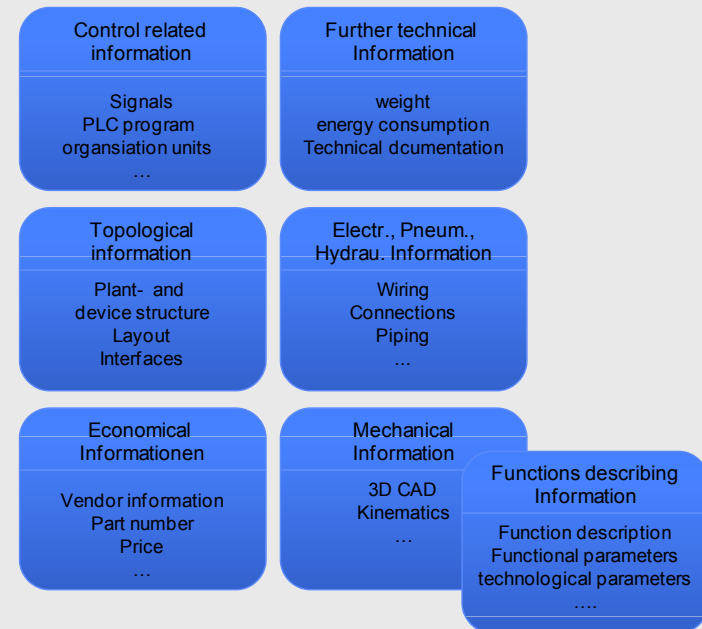
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■ Covered information

- 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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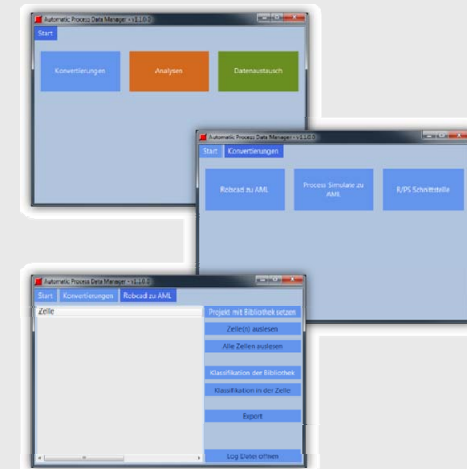
AutomationML IEC Standard Series 62714			Concept	White paper	IEC Sub- mission	IEC Intern. Standard
	Part 1: Architecture	Definition of basic concepts and top level architecture using CAEX				
	Part 2: Libraries	Definition and use of basic and industry specific role libraries				
	Part 3: Geometry	Modelling of geometry and kinematics using COLLADA, Referenzing in CAEX				
	Part 4: Logic	Modelling of behaviour and interlocking using PLCopen XML , Referenzing in CAEX				
	Part 5: Communication	Modelling of communication networks and communication devices using CAEX				
		...				

AutomationML further discussed topics		Concept	Best practice
	Integration of semantic definitions	Application of classification standards for unique semantic representation (eCl@ss)	
	OPC UA Information Model	Access to AutomationML data sets by OPC technology	
	Data security	Integration of XML based data security measures in AutomationML	
	Automation system configuration	Data structuring to express automation system hardware structure	
	Transportation library	Library structure for reusable transportation system modules	
	VDMA data model	Exchange of VDMA data model by AutomationML interfaces	

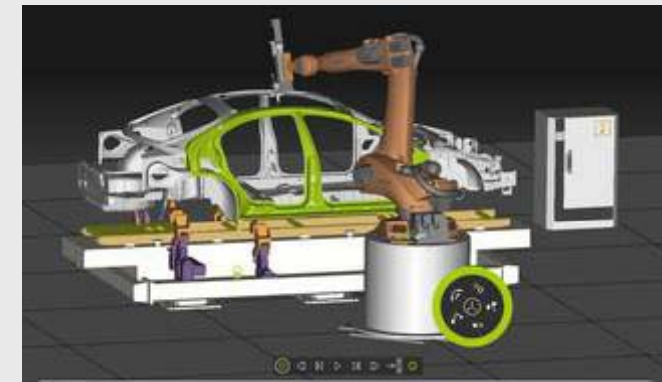
The Present Implementation highlights

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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
- **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.west-gmbh.com/files/content/WEST_APDM_AutomationML_2014.pdf

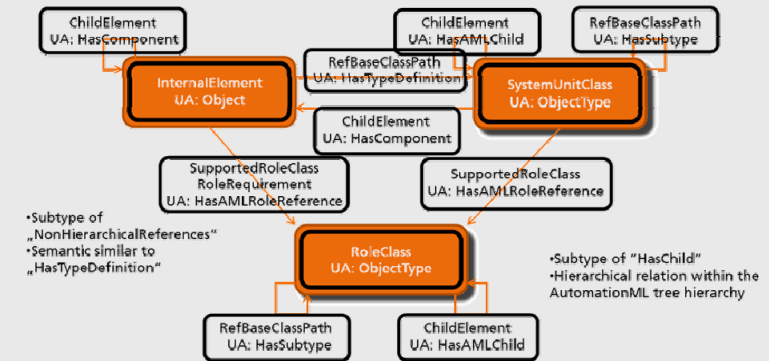


Source: www.cenit.com/en_EN/plm/digital-factory/software/fastsuite-edition-2.html

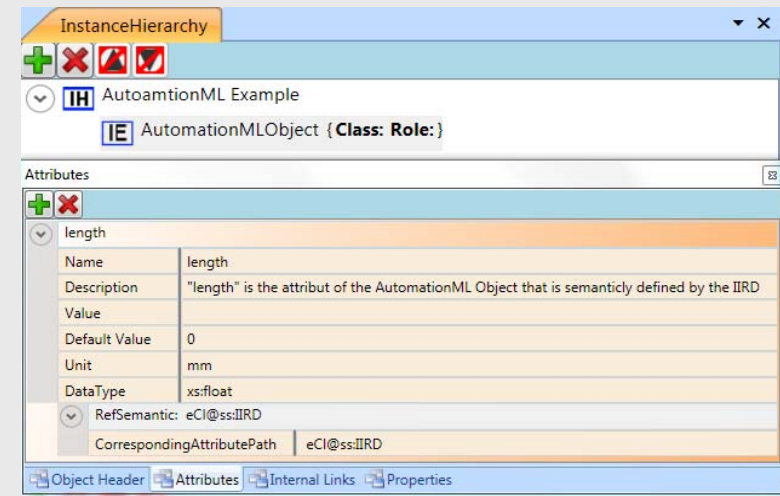
The Future Started activities

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- **OPC UA Information Model**
 - Mapping of AutomationML data structure to OPC UA data model
 - Definition of integration process
 - Identification of application scenarios
- **Integration of semantic definitions**
 - Definition of two levels of semantic integration
 - Specify object and attribute semantic
 - Create eCI@ss plain role library
 - Identification of application scenarios



Source: Fraunhofer IOSB Karlsruhe



Source: INPRO Berlin

The Future Started activities

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■ 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 screenshot displays the AutomationML software interface. On the left, a hierarchical tree structure shows the configuration of a control system, starting with 'Roboterzeile1' and branching into various components like 'Link_PhysicalConnection', 'Link_RFIDReader', 'Link_Antrieb', 'Link_PhysicalConnection_Ventilinsel', 'Link_Switch', 'Link_PhysicalConnection_SPS', 'Link_Datagram', and 'Link_PhysicalConnection_SPS_Switch'. The right pane shows the properties of the selected component, 'Link_PhysicalConnection_SPS_Switch'. The properties are organized into sections: 'Name', 'Description', 'Value', 'Default Value', 'Unit', 'DataType', and 'RefSemantic'. The 'Name' field is highlighted, and the 'RefSemantic' field is set to 'e:class#8.1#1000'. Below the main interface, two small tables are shown, likely representing data or configuration parameters.

Name	Hersteller-Name
Description	
Value	
Default Value	
Unit	
DataType	xstring
RefSemantic	e:class#8.1#1000

Name	OverallApplication
Description	
Value	
Default Value	
Unit	
DataType	xstring

Name	MAC Adresse
Description	
Value	
Default Value	
Unit	
DataType	xstring

The Future

Running research projects (selection)

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- **ReApp**

- Tool chain for intelligent robot programming capable to automatically 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**

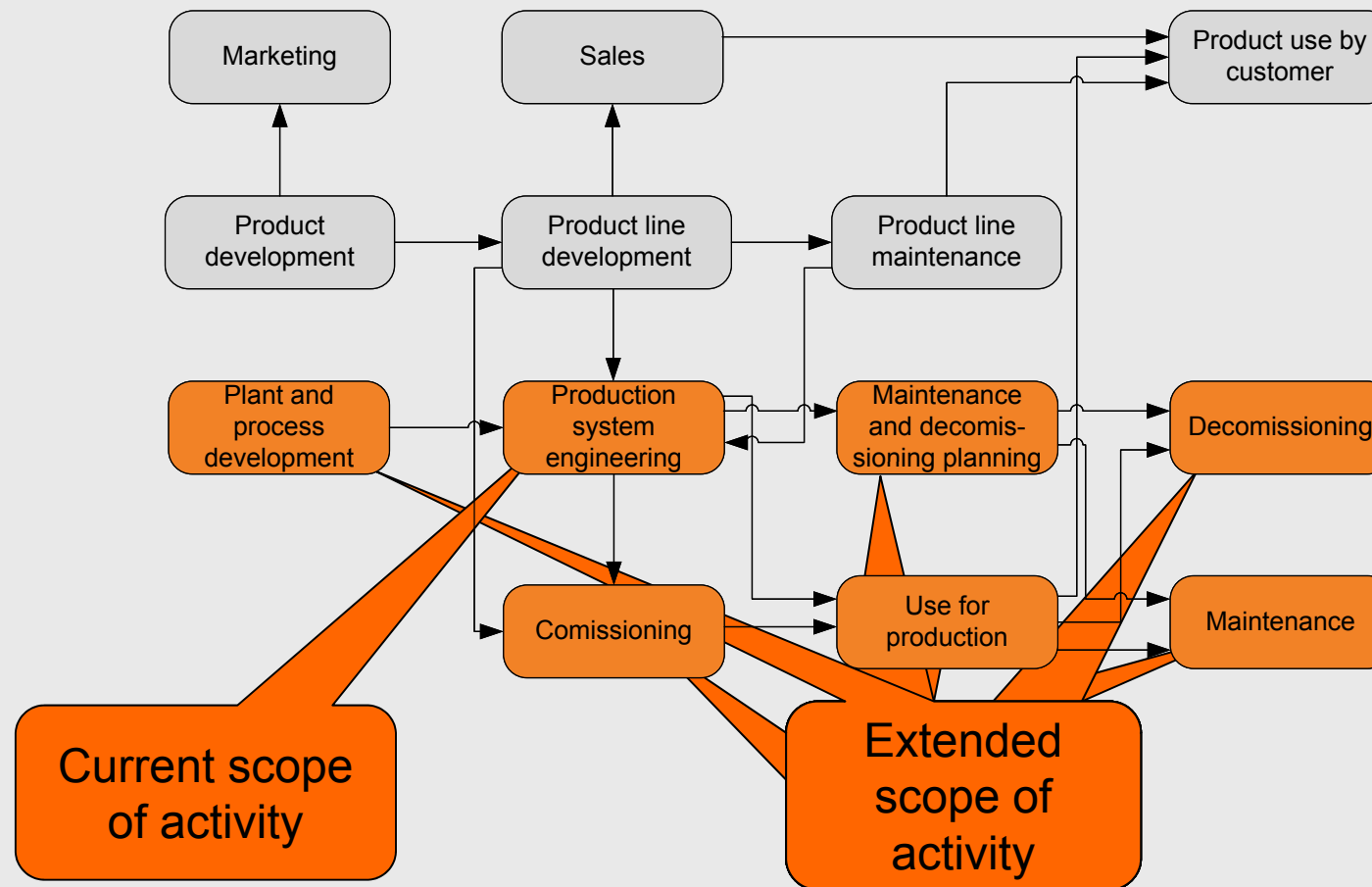
- Tool for discipline crossing planning and product related virtual optimization of automated production systems



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

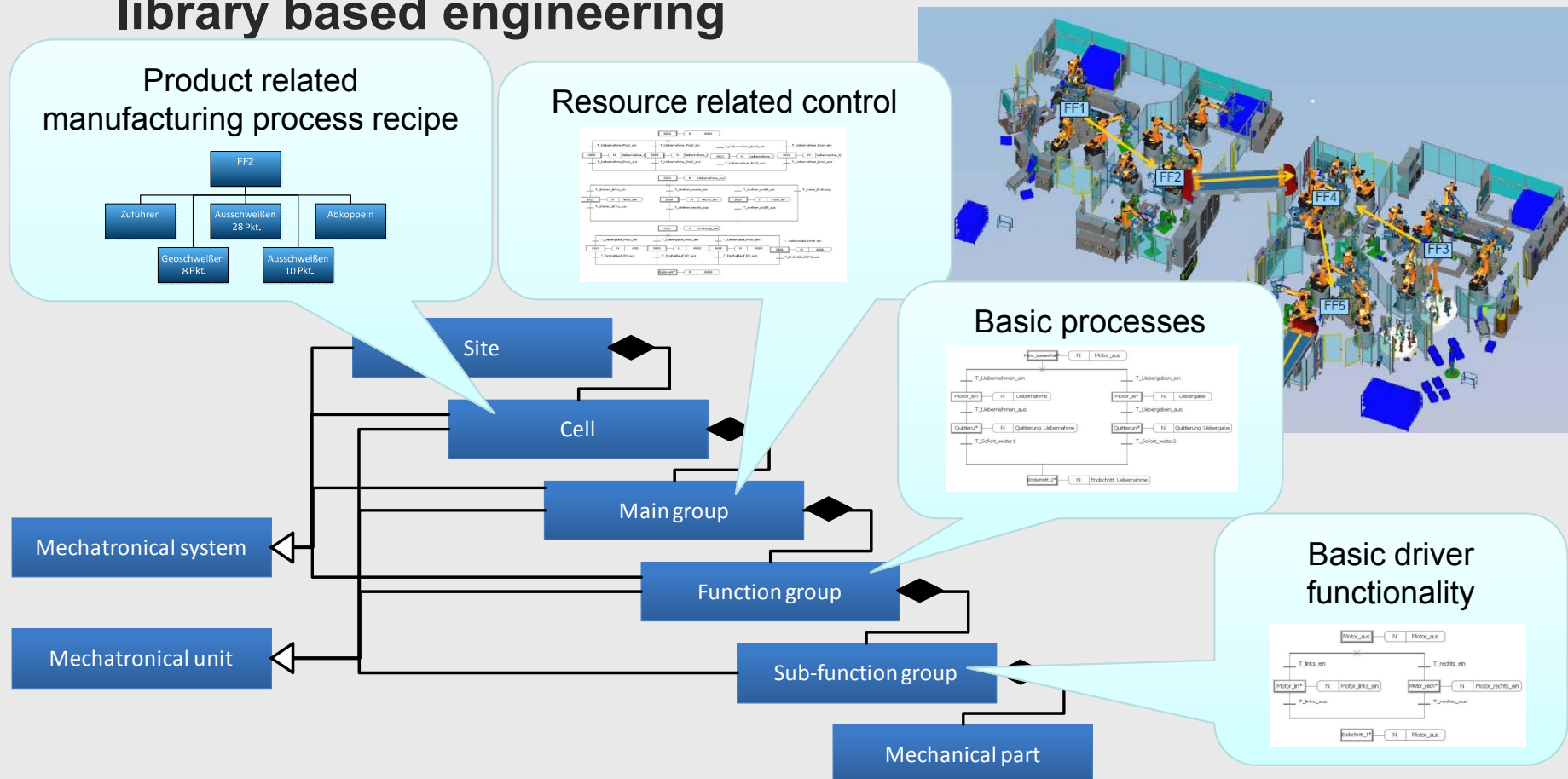
- **Current mega trend in Germany**
- **Aims:**
 - Integration of advanced IT capabilities like Internet of Things and Services, Cloud computing, and Big Data within industrial information processing on all layers of control
 - Ensure horizontal integration along value chain networks, vertical integration 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

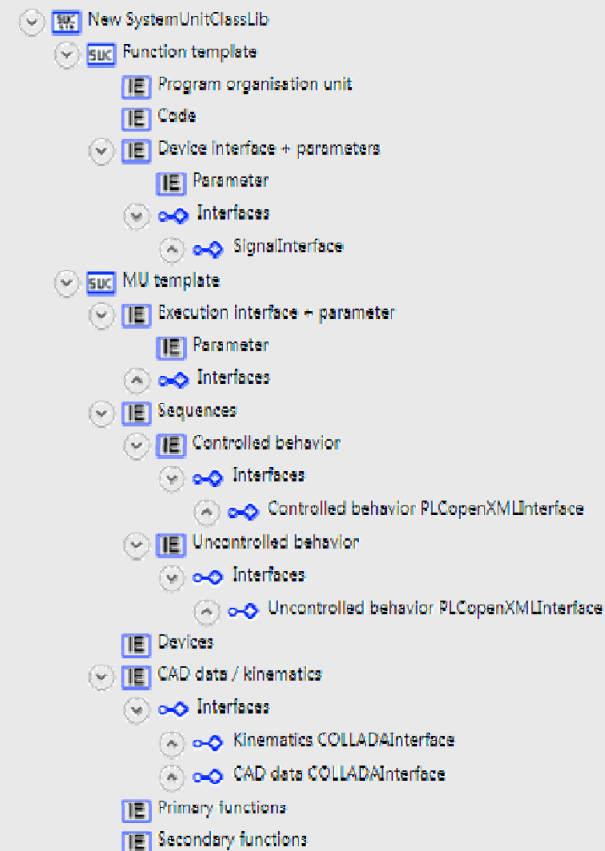


- **AutomationML can be exploited to**
 - Model Industrie 4.0 components as mechatronic objects including structure and behavior modeling to enable library based engineering
 - Model process descriptions both as required and provided processes to enable automatic resource selection within flexible production
 - 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
 - ...

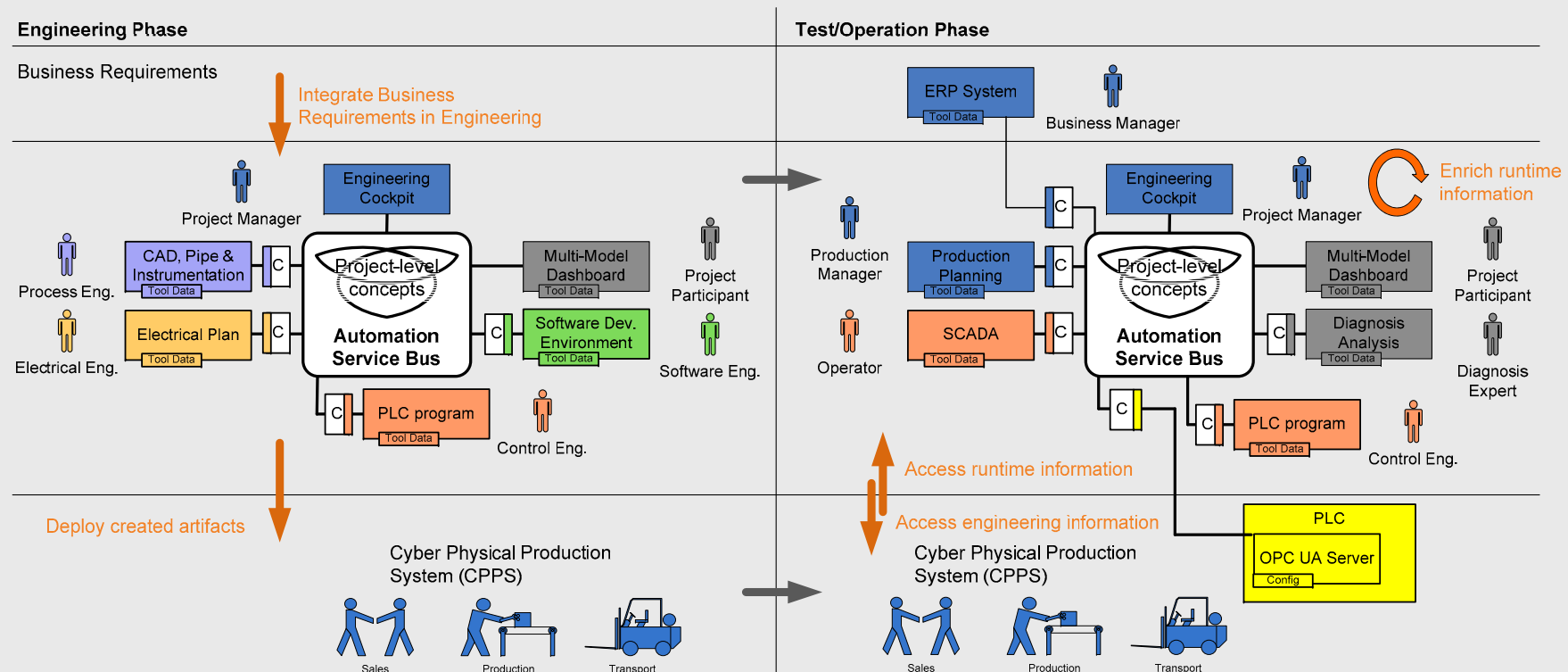
- Model Industrie 4.0 components as mechatronic objects including structure and behavior modeling to enable library based engineering



- **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





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"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