



Implementation of an AML-Interface in AVANTI Project

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Ender Yemenicioglu



Purpose: A versatile, flexible, and comprehensive modelling framework for Virtual Commissioning projects

Requirement: A format, which is suitable for exchanging behavioral modelling of mechatronic engineering objects in the context of Virtual Commissioning.

Following aspects should be regarded:

- Visualization of the scene (Geometry, position)
- Physical aspects including kinematic and dynamic processes as well as external stimuli
- Control and logical aspects (signals, commands, and interrupts issued by PLC devices)
- Real-time capability (For PLC testing)



AutomationML combines the topology, geometry, kinematic, physic, logic information as well as possibly other XML based information.

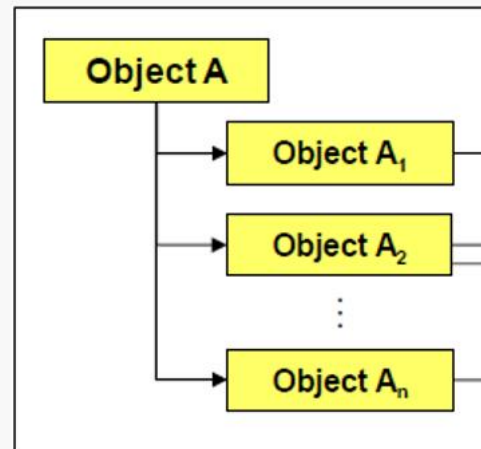
Automation Markup Language

Engineering data

CAEX IEC 62424 Top level format

Plant topology information

- Plants
- Cells
- Components
- Attributes
- Interfaces
- Relations
- References



COLLADA

Geometry
Kinematics
Physics



PLCopen XML

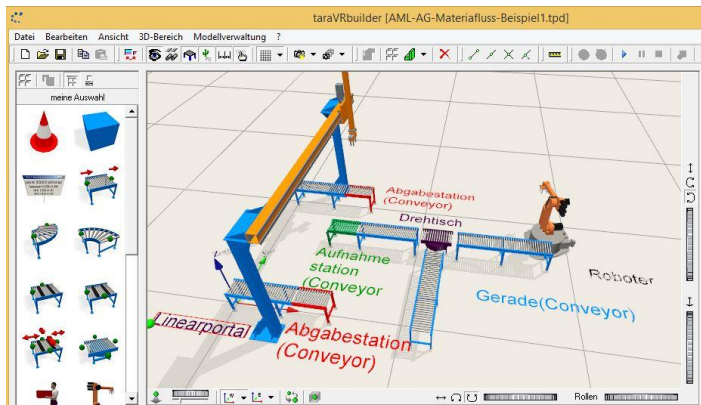
Behaviour
Sequencing



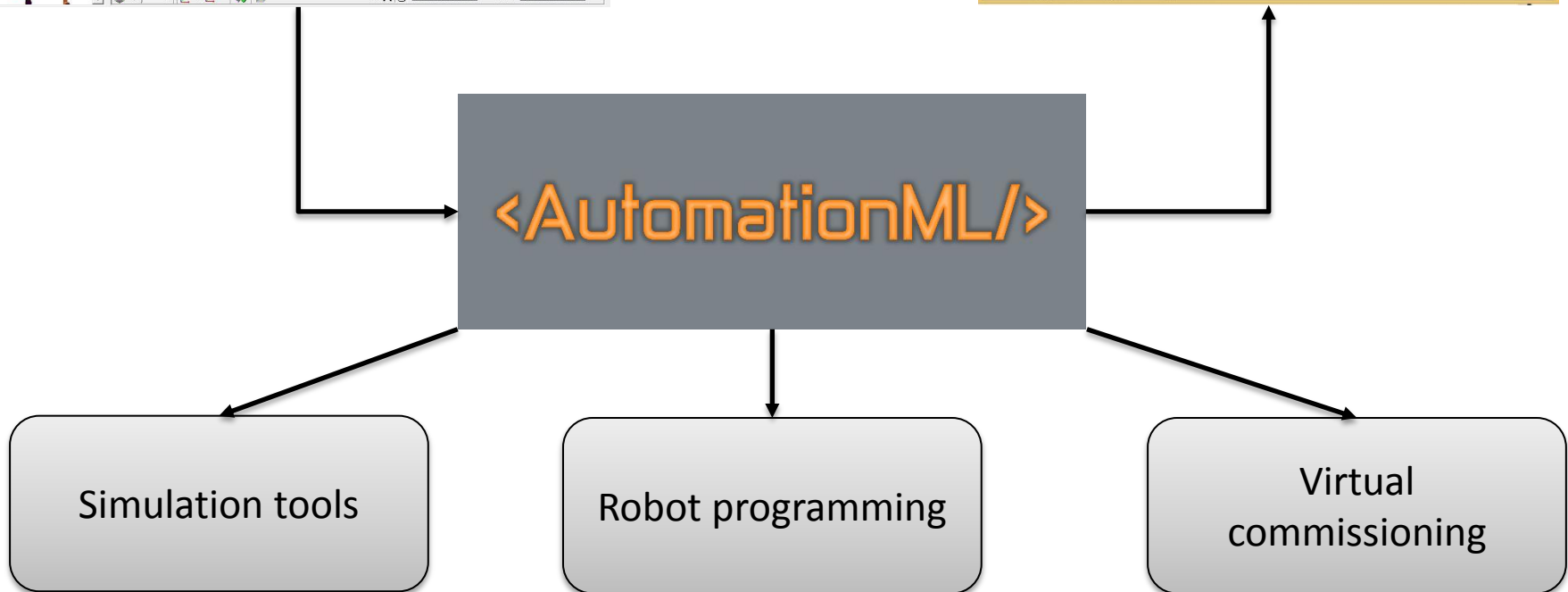
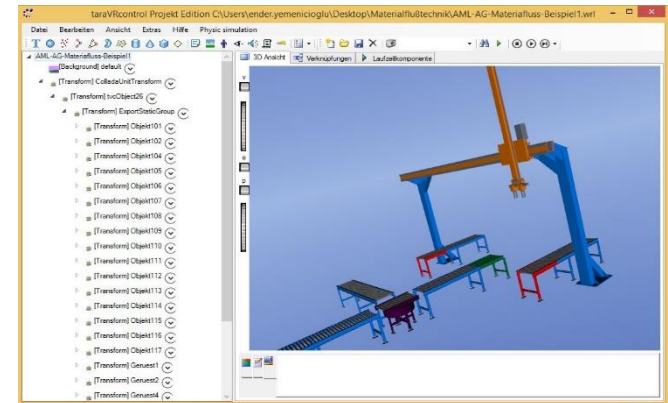
Further XML Standard format

Further aspects of
engineering information

Layout planning tool

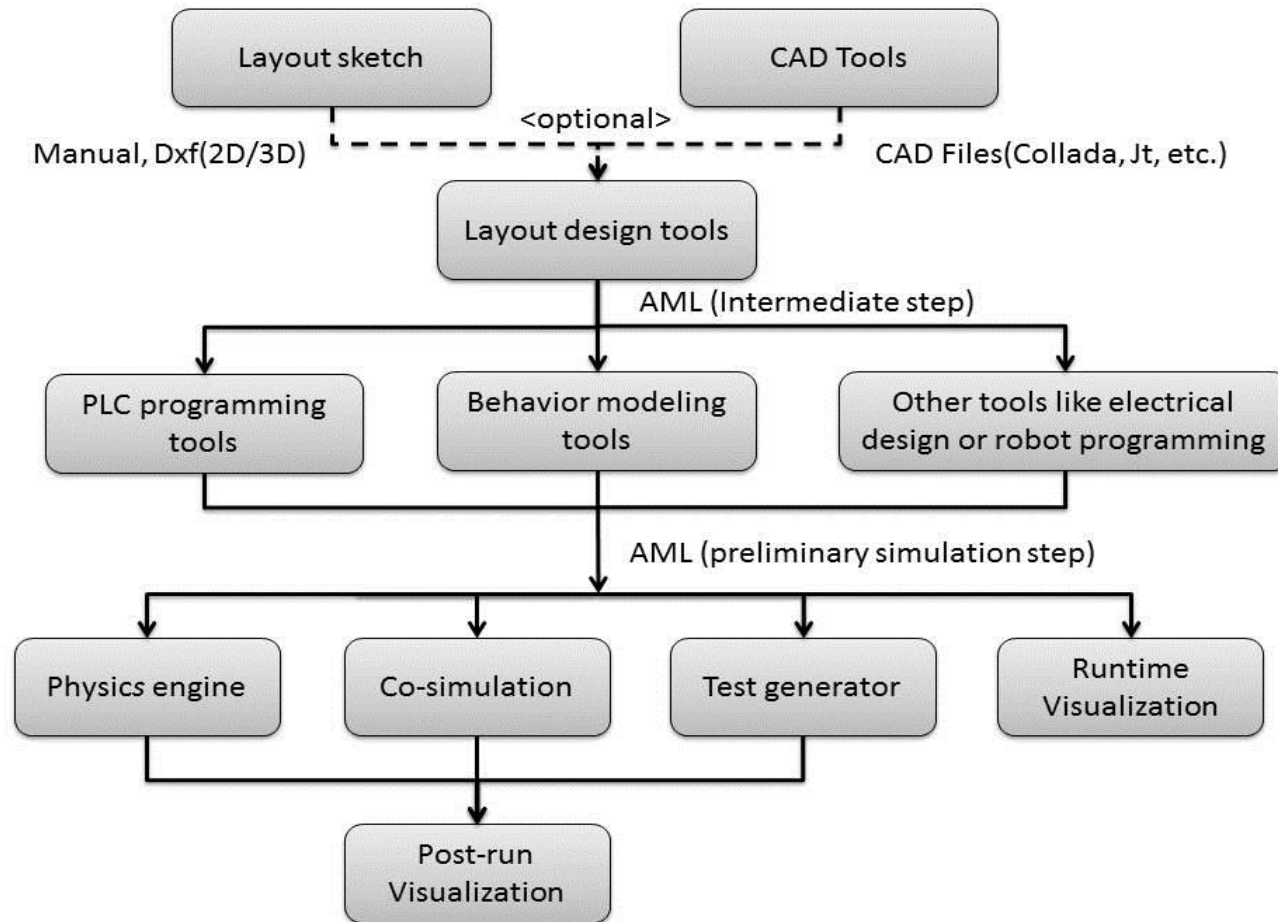


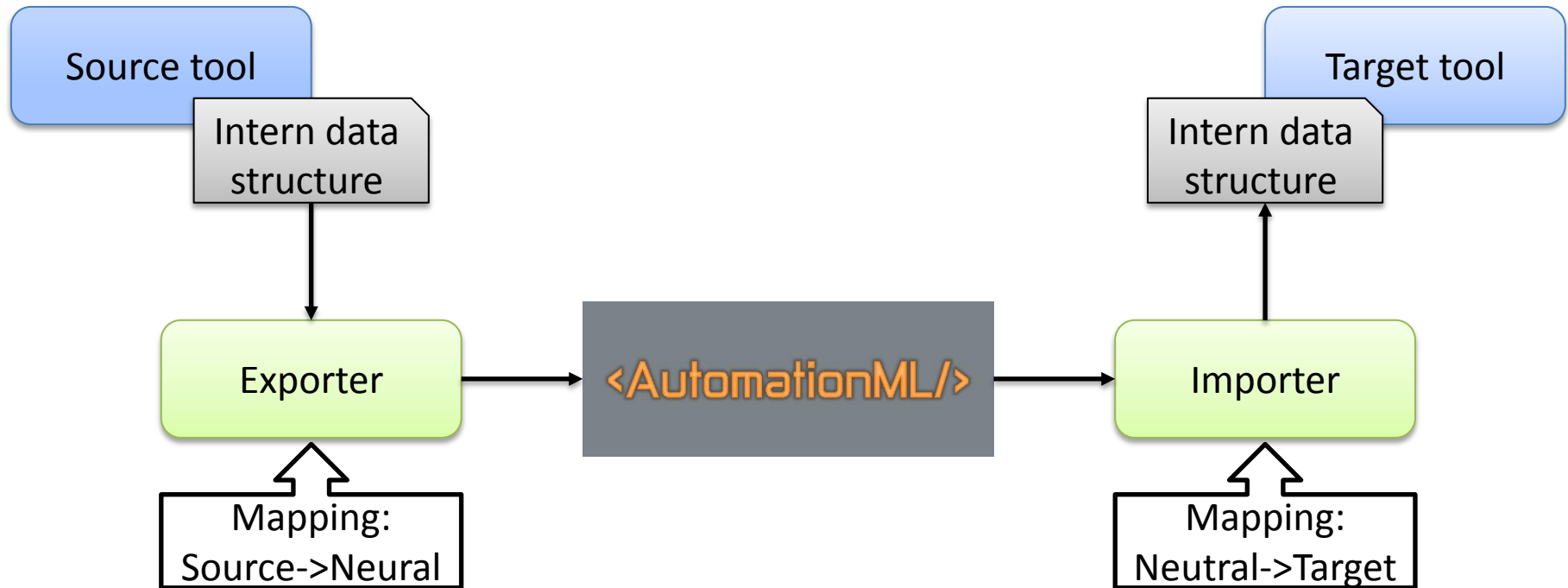
Visualisation tool





Plant simulation process and implementation of AutomationML



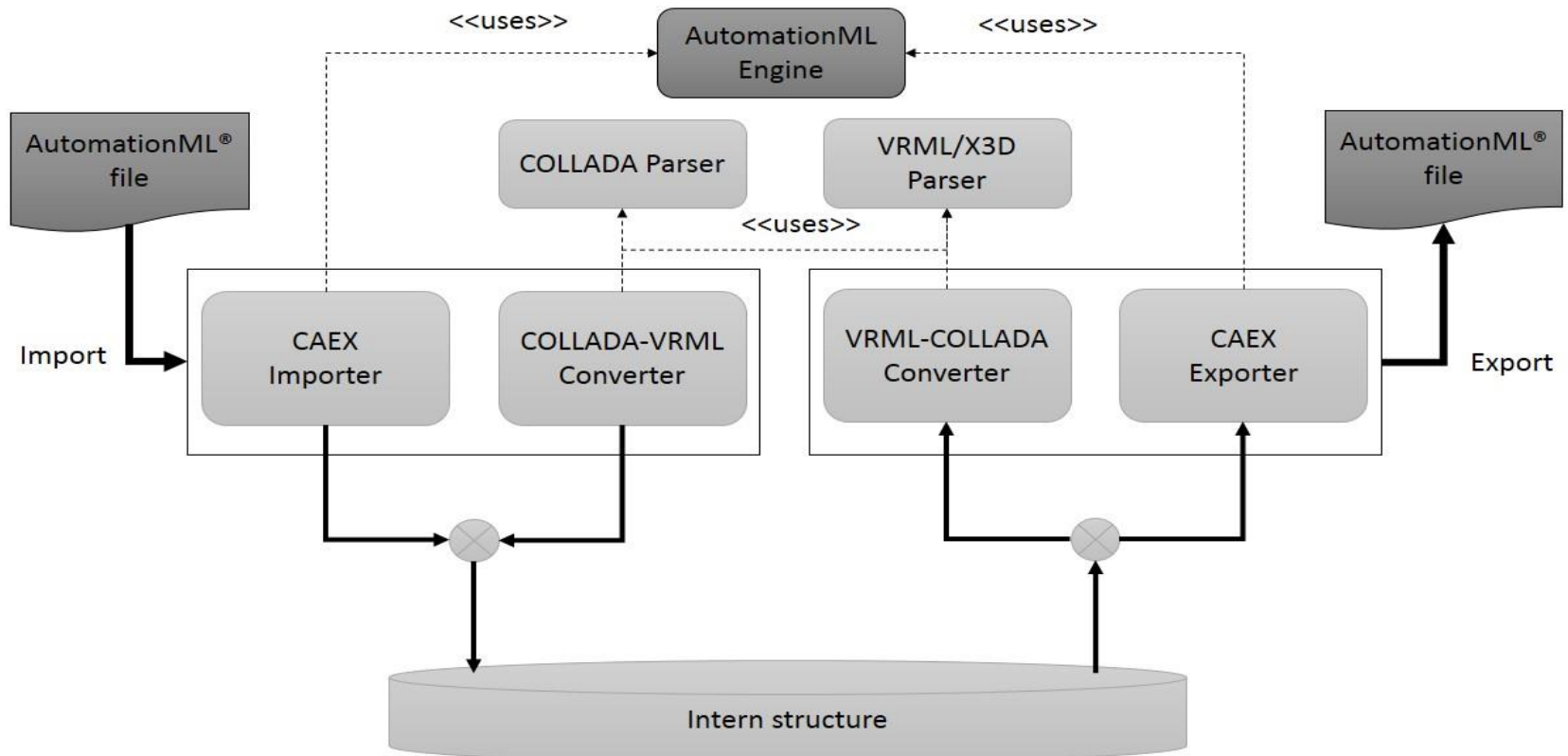


- 1) The exporter reads the information from the intern data structure of the source tool.
- 2) The exporter transforms the information to the data exchange format.
- 3) The importer from the target tool reads the information from the data exchange format.
- 4) The importer transforms the information to the intern data structure of the target tool.

* Drath, R., & Barth, M. (2013). Wie der Umgang mit unterschiedlichen Datenmodellen beim Datenaustausch im heterogenen Werkzeugumfeld gelingt. Tagungsband AUTOMATION.

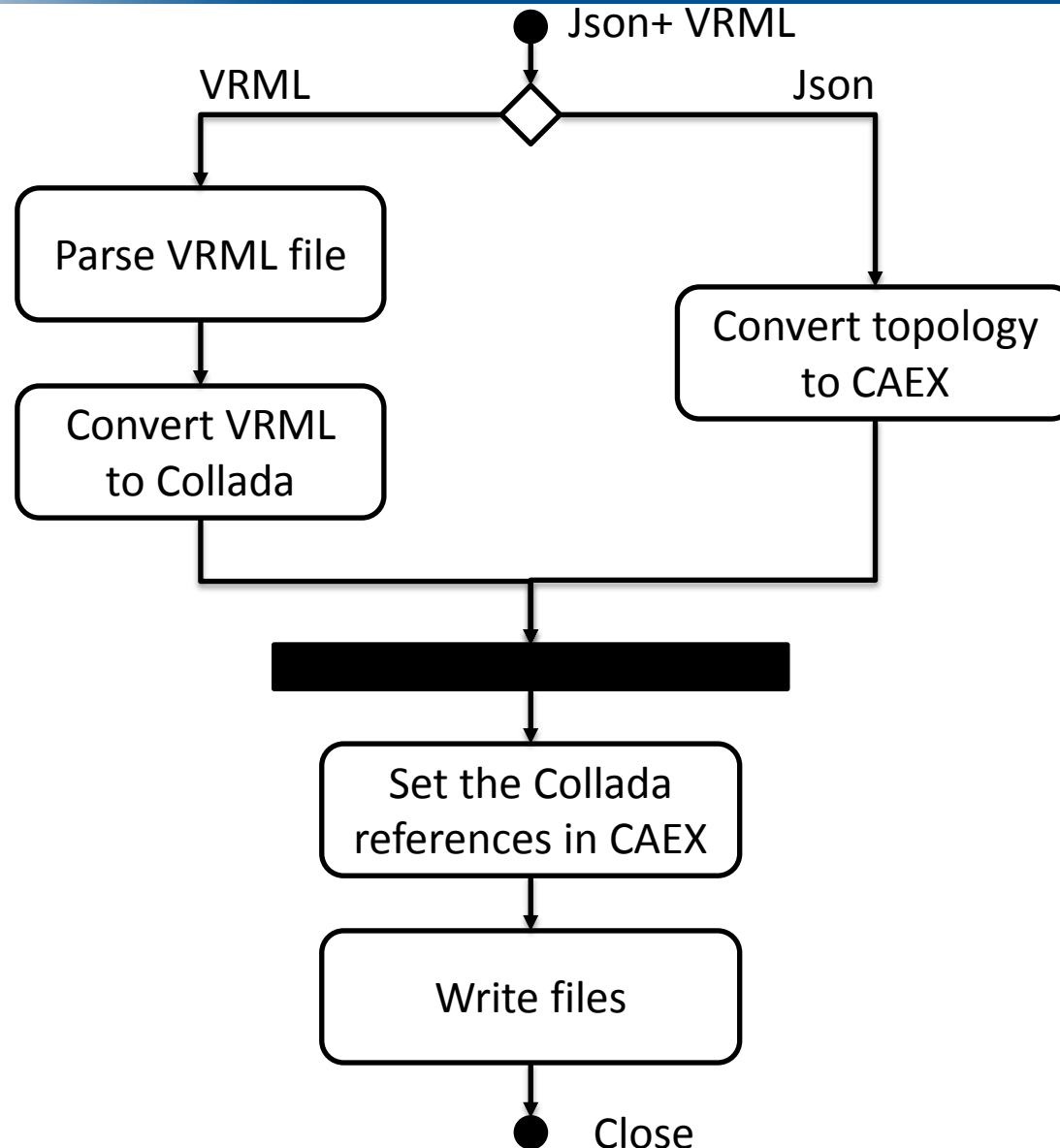


Software components of the AutomationML importing and exporting functionalities



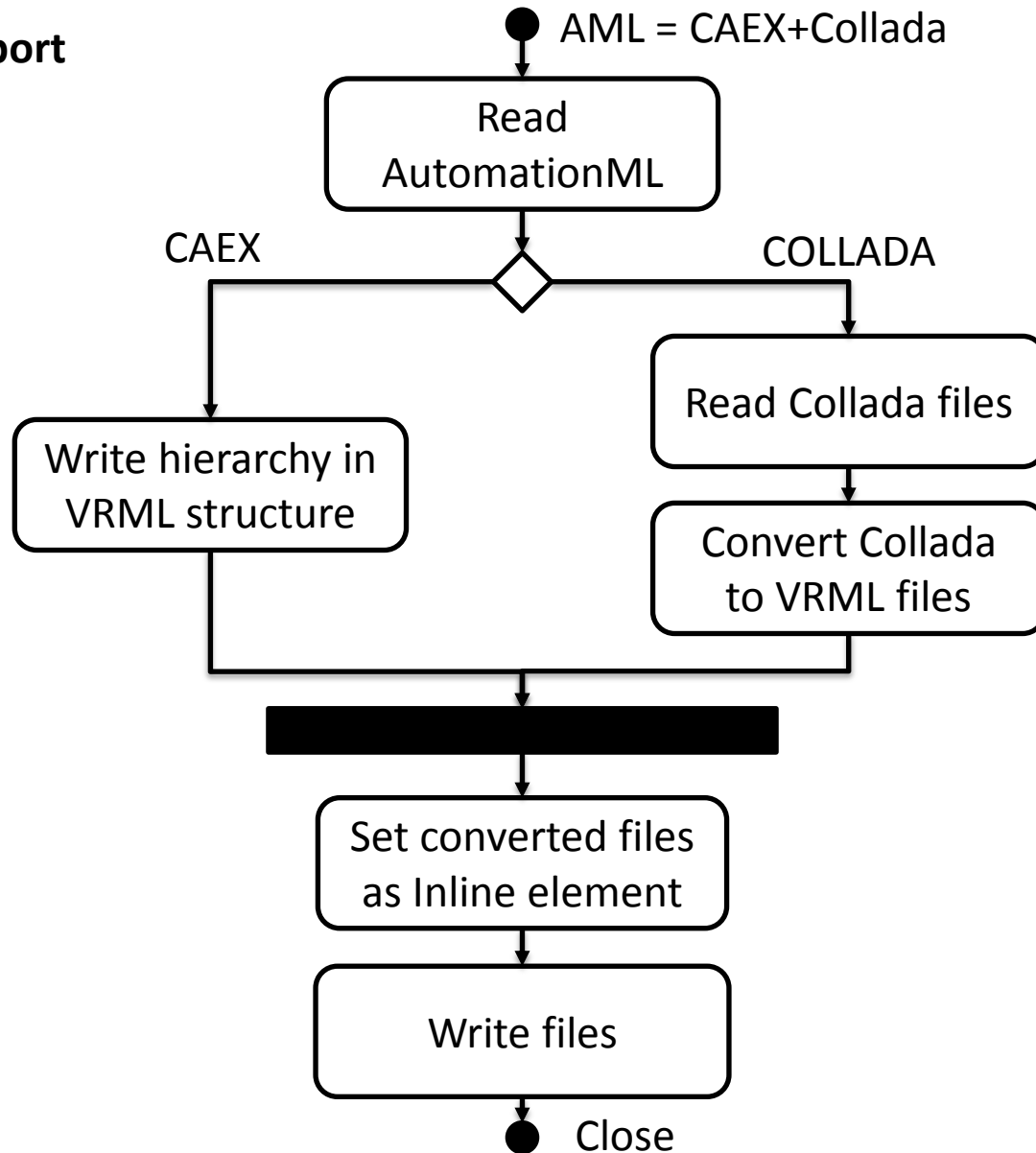


Flow chart of export function





Flow chart of import function





Collada to VRML(X3D)/ VRML(X3D) to COLLADA

COLLADA	X3D
Lines	PointSet, IndexedLineSet
LineStrips	IndexedLineSet
Triangles	IndexedTriangleSet, IndexedFaceSet
Tristrips, Trifans	IndexedFaceSet
Polygons, Polylists	IndexedFaceSet
X3D	COLLADA
PointSet	Lines
IndexedLineSet	LineStrips
TriangleSet, IndexedTriangleSet	Triangles
TriangleFanSet, IndexedTriangleFanSet	Trifans
TriangleStripSet	Tristrips
IndexedFaceSet	Polygons
Cylinder, Cone, Sphere, Box	Triangles (Triangulation)
Extrusion	Polygons (Triangulation)



Following aspects can already be identified in the existing data exchange flow with the help of standard defined components:

- 1)Meta information from exporter like name, version, creation date, etc.
- 2)Topology (InstanceHierarchy objects)
- 3)Position (Frame attribute)
- 4)Geometry (Extern referencing of Collada files)
- 5)Connection points from components (InternalLink object)

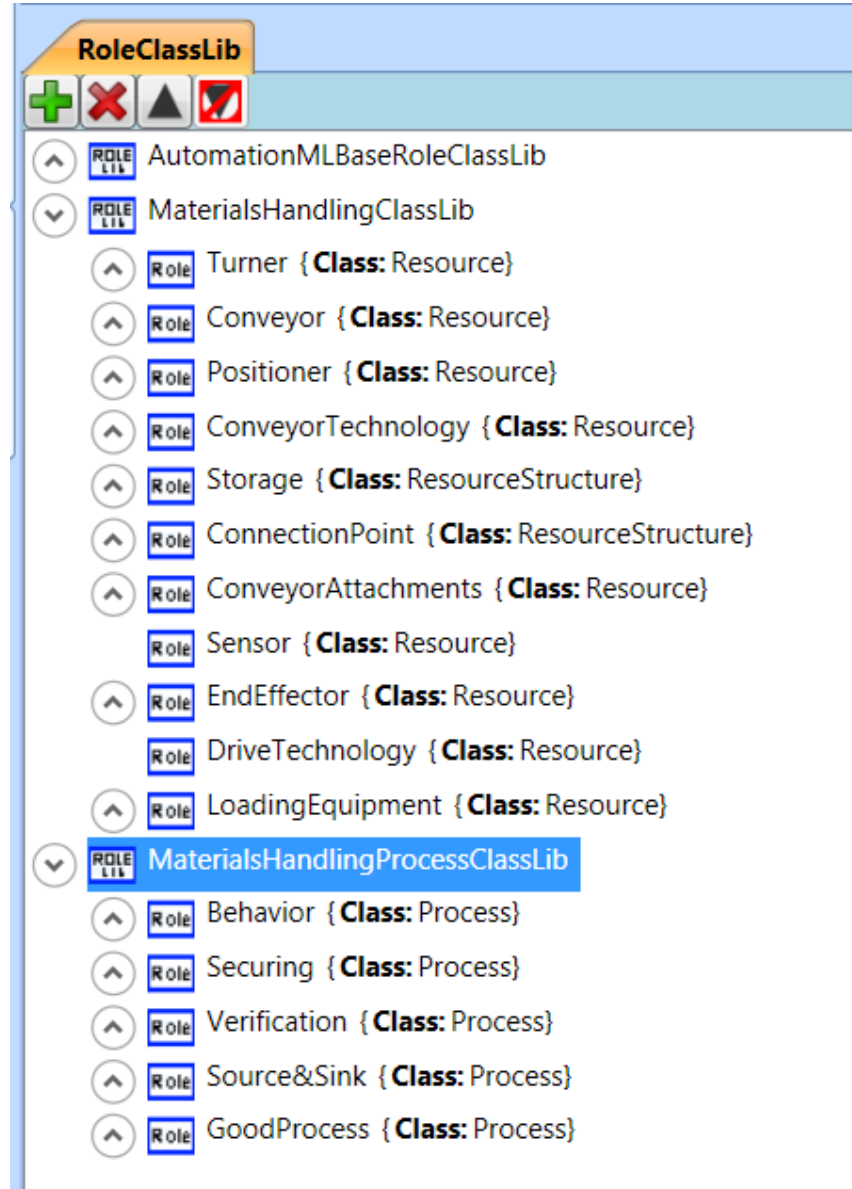
What could also be possible:

- 1)Product-Process-Resource
- 2)Simulation parameters (conveying velocity, maximum last, etc.)
- 3)Conveying strategy (distribution, consolidation, priorities, etc.)

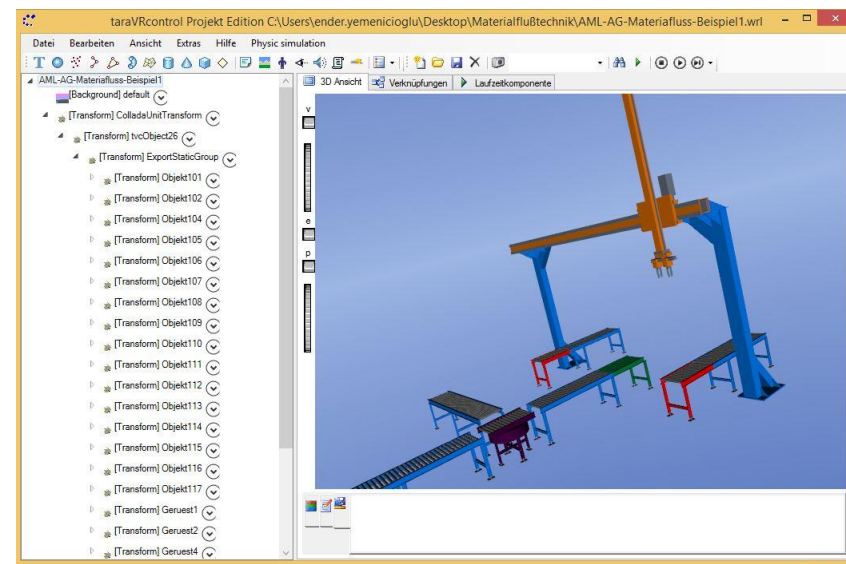
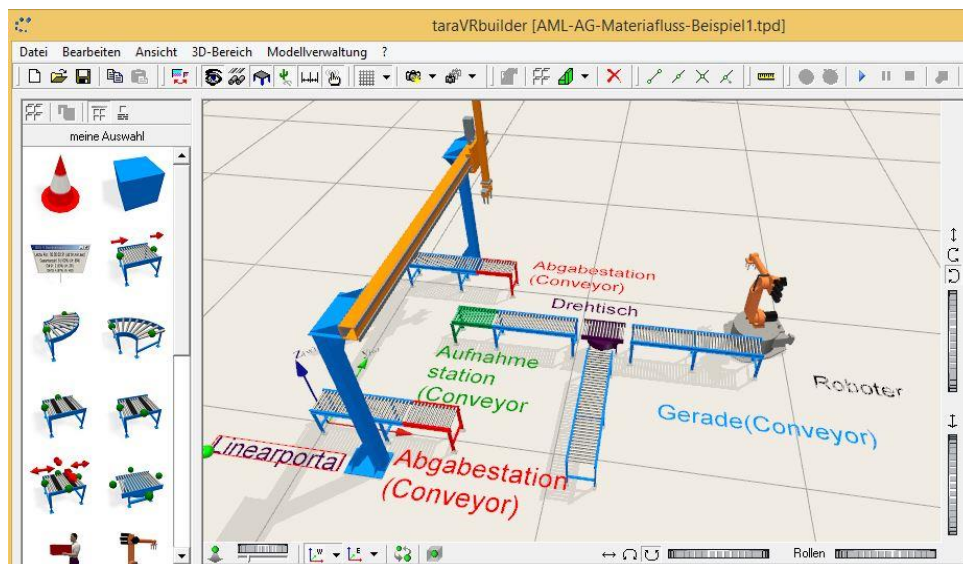


Creation of a standard role class library:

- Small function-based roles
- Separation of concerns: Product, resource, process
- Derived from standard base roles like „Resource“ or „ResourceStructure“
- Comparison with standards like VDI 2860 and VDI 2411
- Cooperation with partners, also with companies and institutions outside the AVANTI project -> Material handling work team



Live demonstration of export and import functions





Questions?
Thank you for your attention.