

Engineering Process with AutomationML

Björn Grimm
Joachim Burlein
TF/P3, Daimler AG

October 7th 2014



Mercedes-Benz

Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

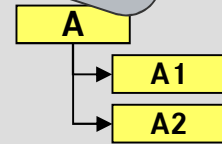
Experiences

Quality of the Data Format

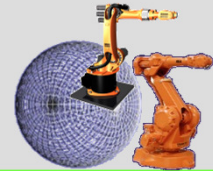
- Data exchange with AutomationML was implemented and tested.
 - Topology with RoleClasses and Libraries
 - Geometry and Kinematics
 - User specific data
- The usage of the logic part is in preparation.
- The data exchange with AutomationML works well.
- Problems with the data format like specification lacks were reported and fixed in the standard.

Retrospective:
AML Conference 2012

Top level format
IEC 62424 (CAEX)



Geometry and kinematic format
COLLADA



Logic format
PLCopen XML



Project specific usage of
IEC 62424 (CAEX)



Summary and Outlook

The first realized use cases showed, that AutomationML is able to become the glue for seamless automation engineering.

Using the data format shows the next tasks:

- Definition of data structures
- Linking of libraries
- Definition of semantics for objects and attributes

The data format is only the first step ...



Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Transfer of material data from material release list

Target application:

Exchange of material metadata and necessary documents (manuals, drawings, maintenance instructions)

Data-Exchange Scenario:

Export from central material database
(iMRM integra Material Release Management, internal tool)

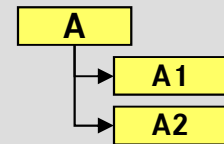


Import in BOM and technical documentation Editor (SLE)
&
Import in ECAD system (EPLAN) material database

Status:

Preparation of Industrial Use

Top level format
IEC 62424 (CAEX)



Geometry and
kinematic format
COLLADA



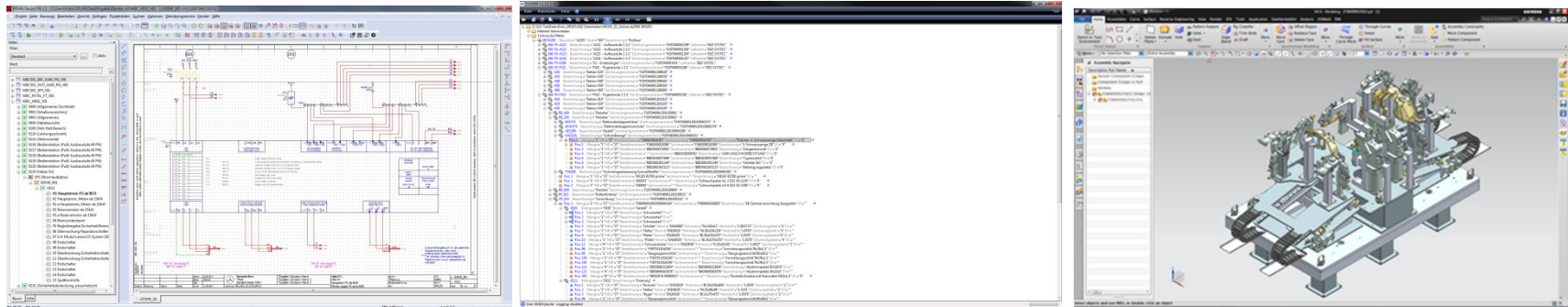
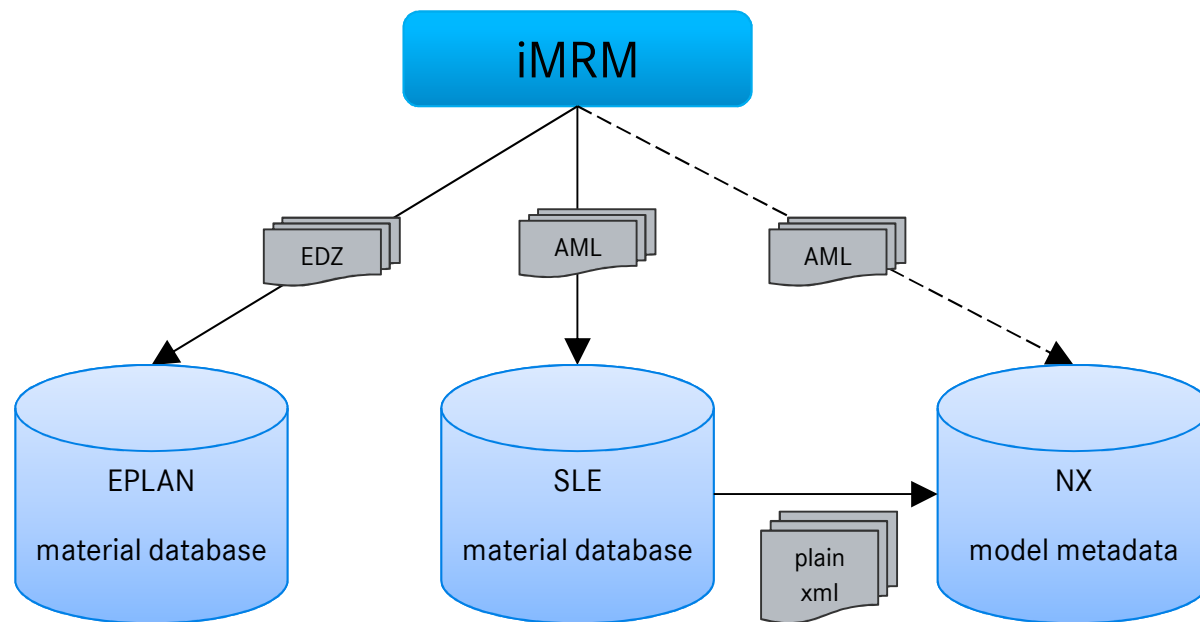
Logic format
PLCopen XML



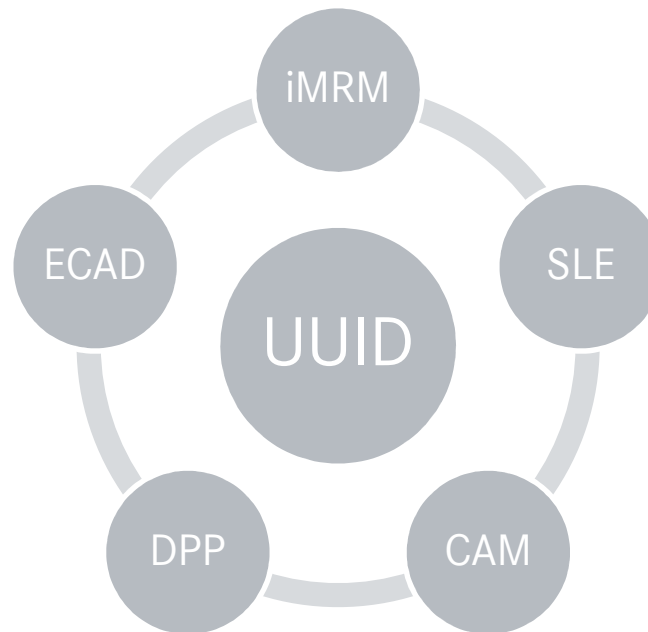
Project specific
usage of
AutomationML



Transfer of material data from material release list



Transfer of material data from material release list



Main goal is to use a unique identifier (UUID) which is used by all engineering tools.

This provides the ability to identify material data in the different engineering tools.

Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- **Example 2: Transfer of engineering data**
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Transfer of engineering data

Target application:

Exchange of detailed engineering data

Data-Exchange Scenario:

**Export additional engineering information from
MCAD System**



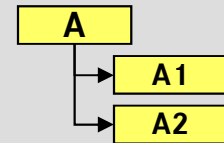
**Import to engineering tools along the engineering chain
&**

Use export for automatic creation of technical documents

Status:

Preparation of Industrial Use

**Top level format
IEC 62424 (CAEX)**



**Geometry and
kinematic format
COLLADA**



**Logic format
PLCopen XML**



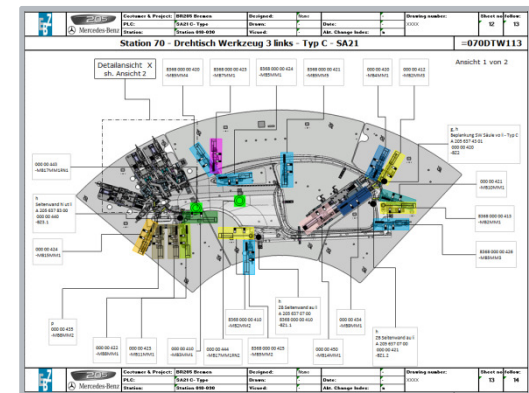
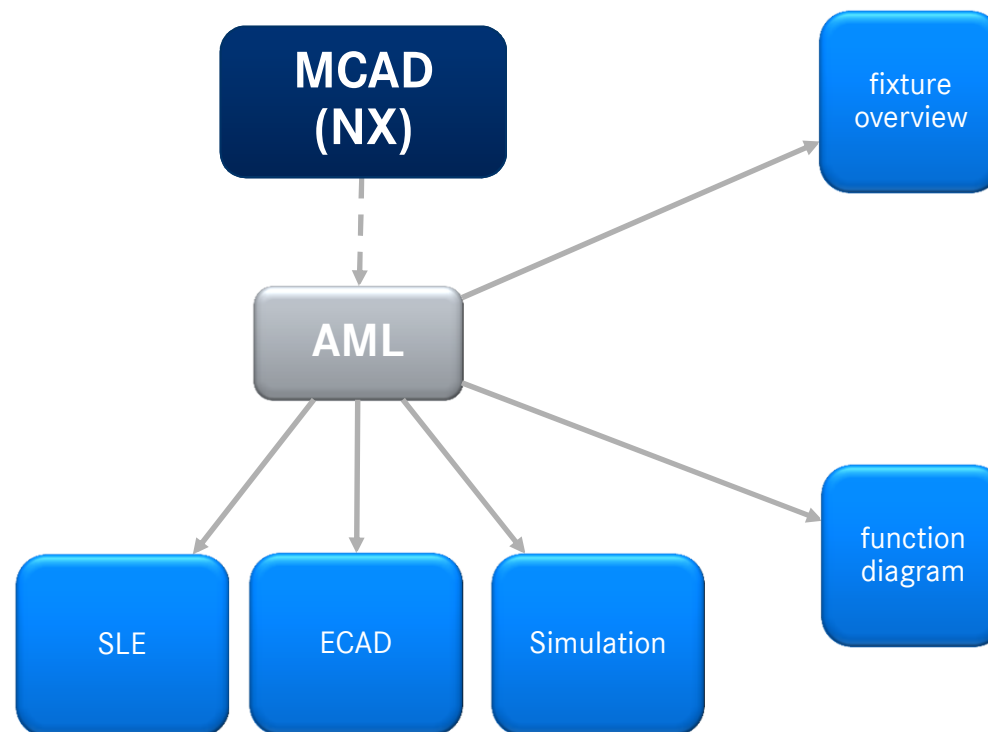
**Project specific
usage of
AutomationML**



Transfer of engineering data (NX)

AML Export from MCAD system (NX) is used for creation of fixture overviews and function diagrams.

Goal is to use the same export for all engineering tools.



The image shows a complex engineering data table, likely a Bill of Materials (BOM) or assembly list. It contains multiple columns of data, including part numbers, descriptions, quantities, and other technical specifications. The table is organized into several sections, with some rows highlighted in yellow and others in blue.

Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- **Example 3: Body in White Planning**
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Body in White Planning

Target application:

Exchange of planning data between various engineering systems during body in white planning processes

Data-Exchange Scenario:

Export from rough planning tool



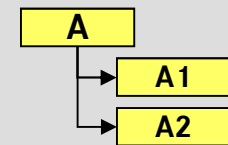
Import in detail planning tool

Status:

Preparation of Industrial Use

Usage of AutomationML

Top level format
IEC 62424 (CAEX)



Geometry and
kinematic format
COLLADA



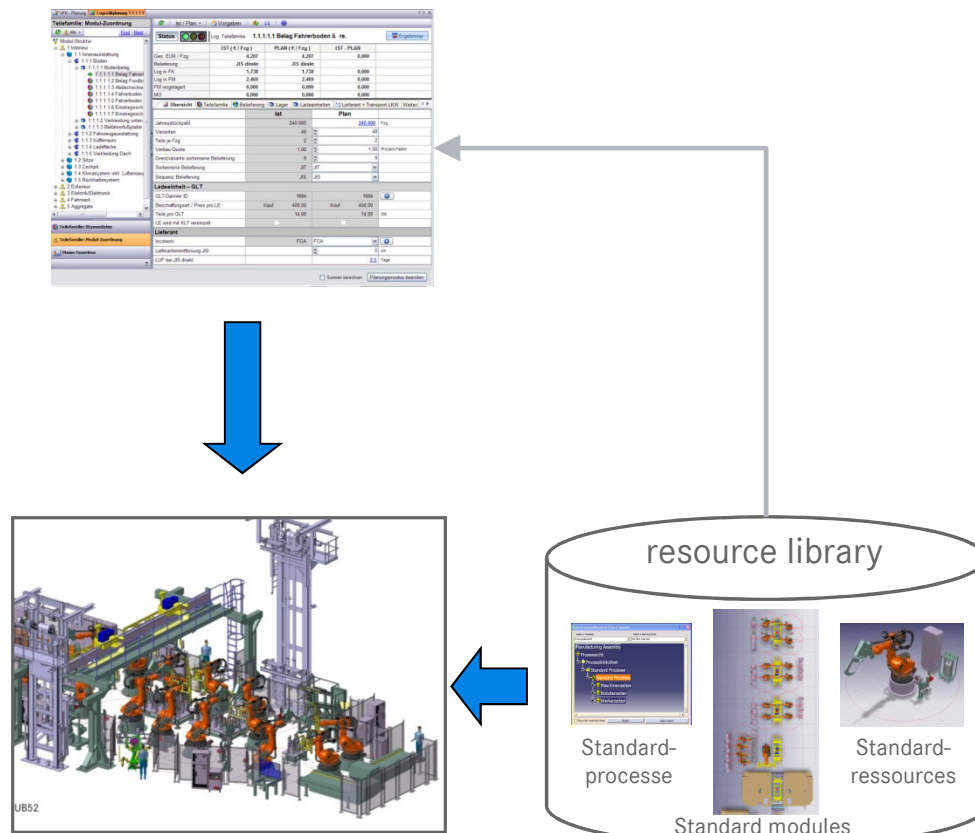
Logic format
PLCopen XML



Project specific
usage of
AutomationML



Body in White Planning

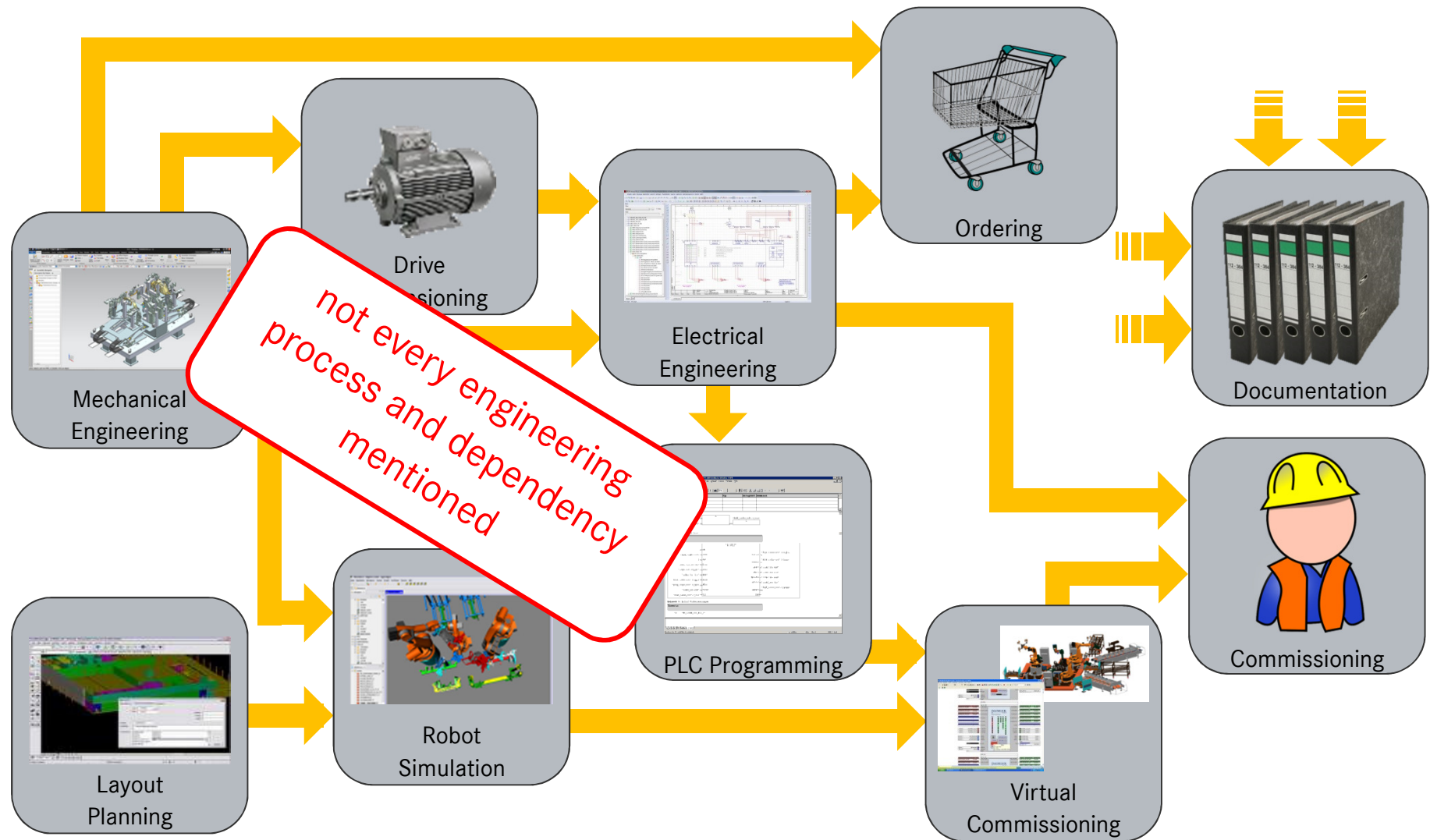


- Export of topology of rough planning tool to AutomationML
- Import of AutomationML in detail planning tool, export even possible
- Usage of AutomationML export for other disciplines in preparation
- Sharing of libraries with the help of AML between different users and tools

Agenda

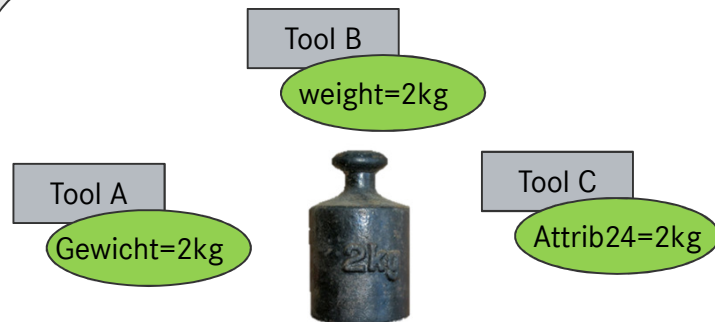
- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Totally integrated Engineering Workflow

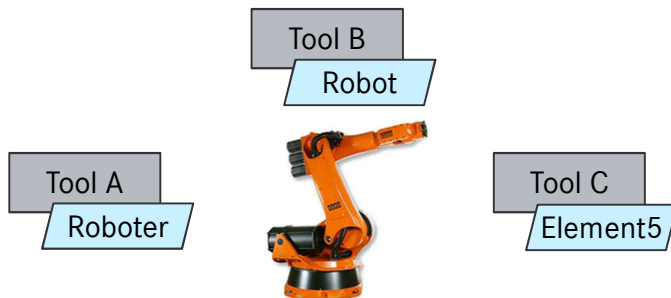


Some Challenges

Semantics

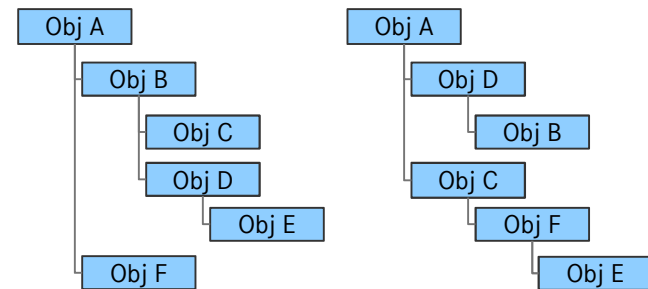


Different attribute names

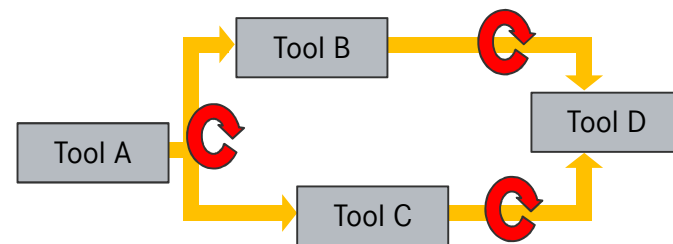


Different object type names

Object identification



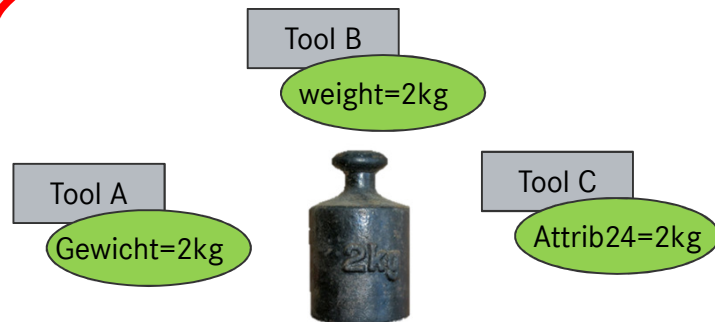
Different Topologies



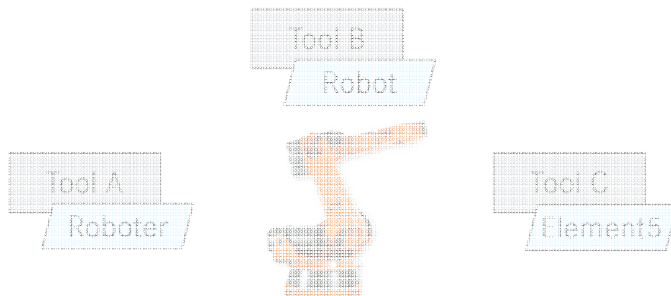
Non sequential engineering processes

Some Challenges

Semantics

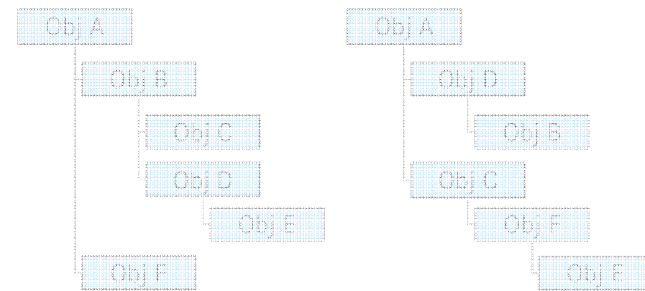


Different attribute names

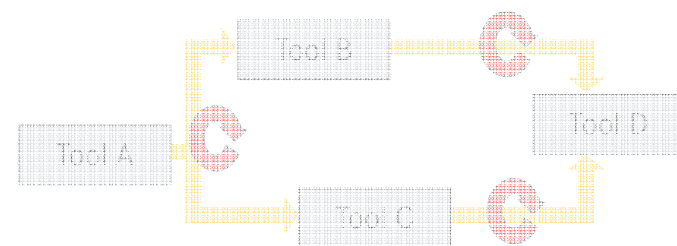


Different object type names

Object identification

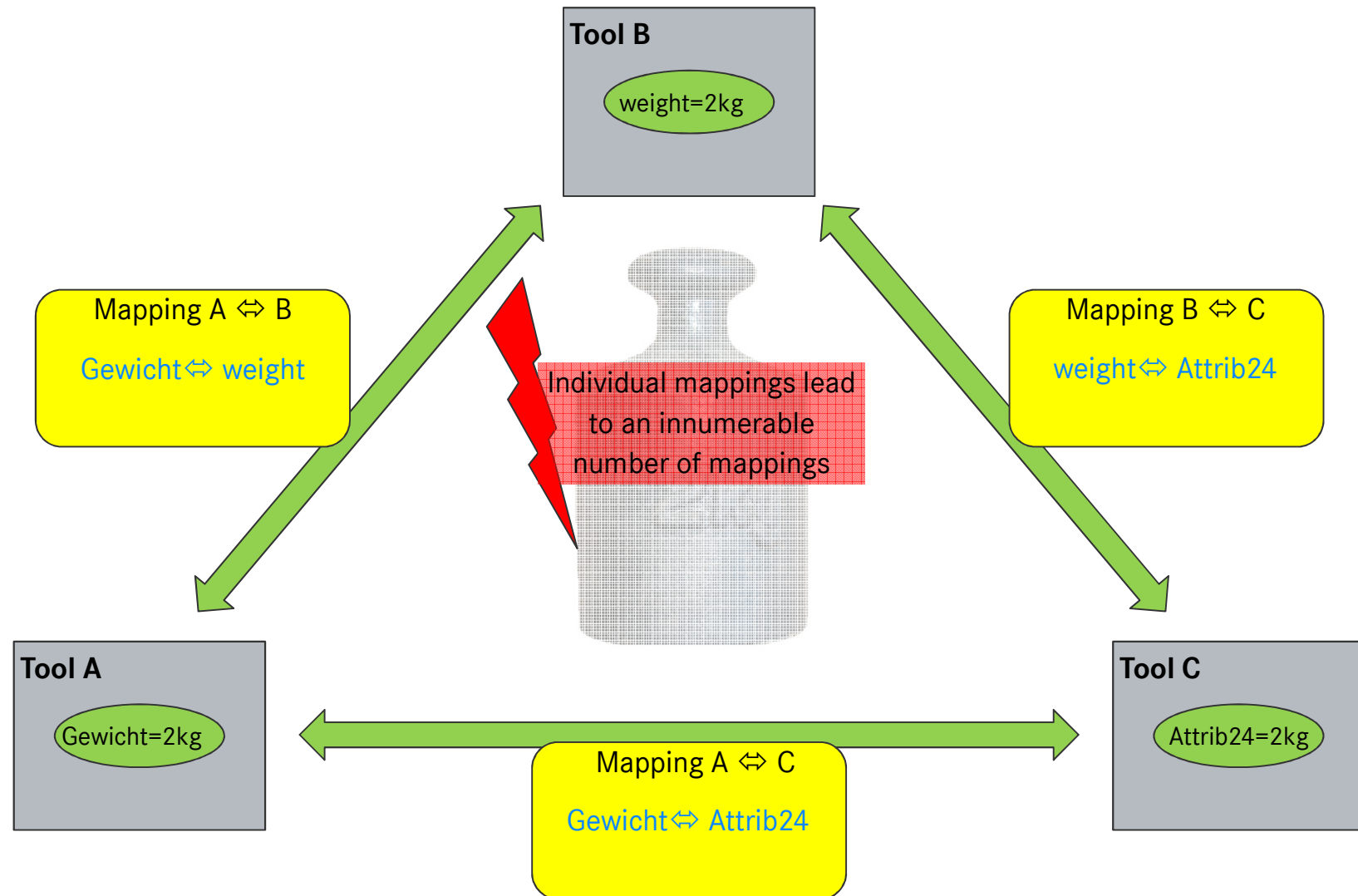


Different Topologies

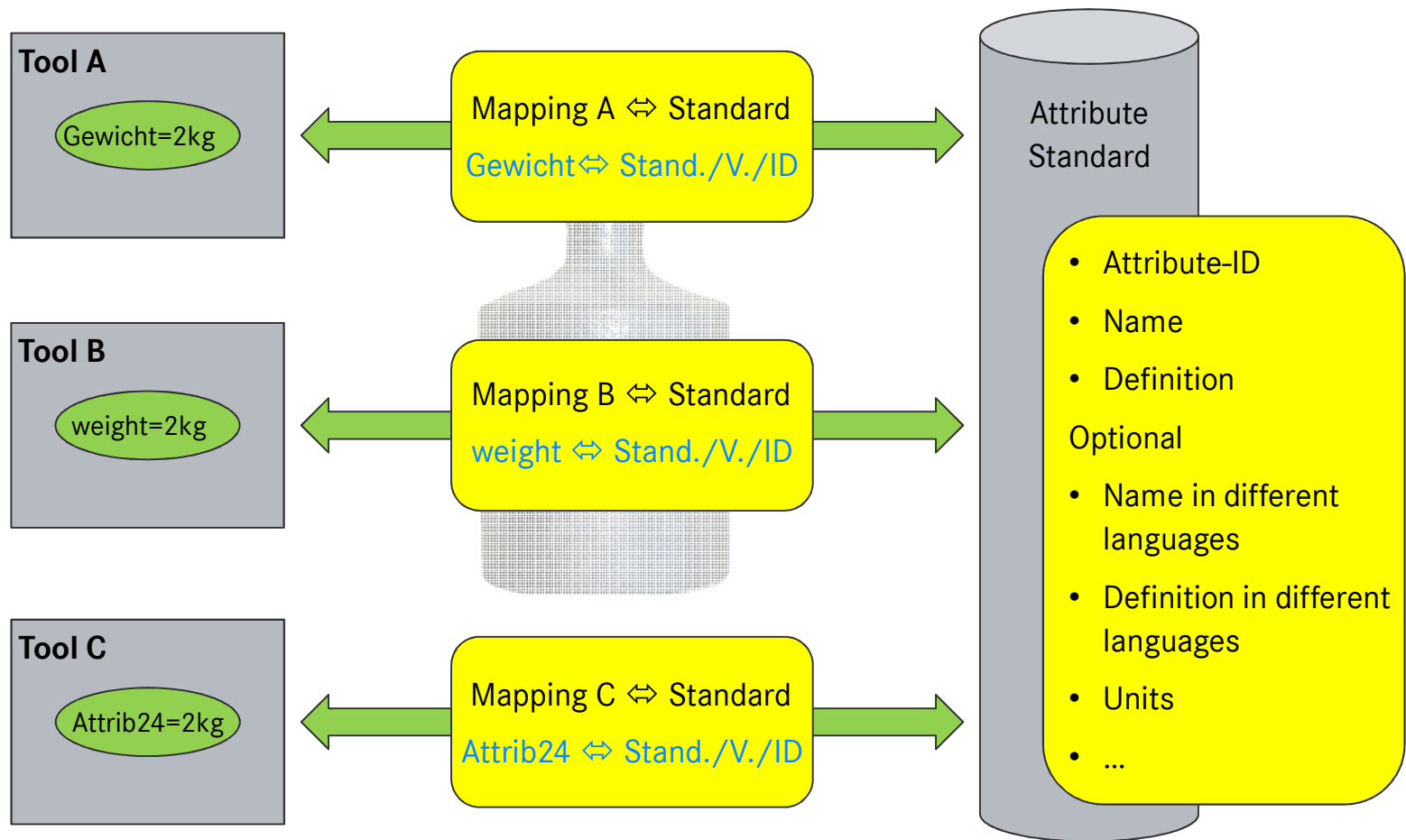


Non sequential engineering processes

Challenge: Different attribute names

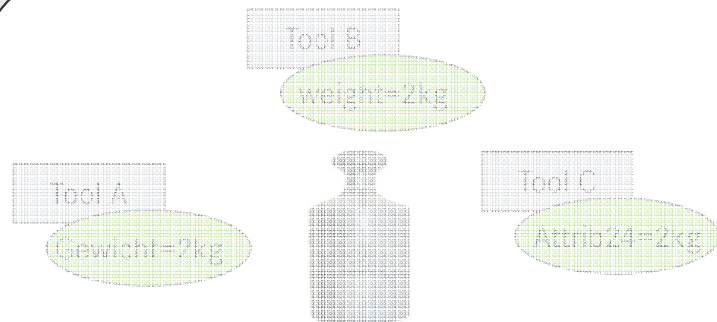


Proposal for attribute semantics

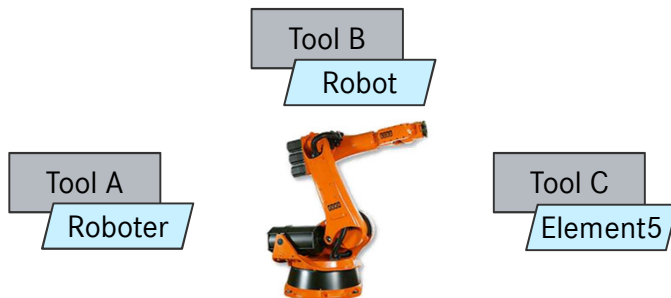


Some Challenges

Semantics

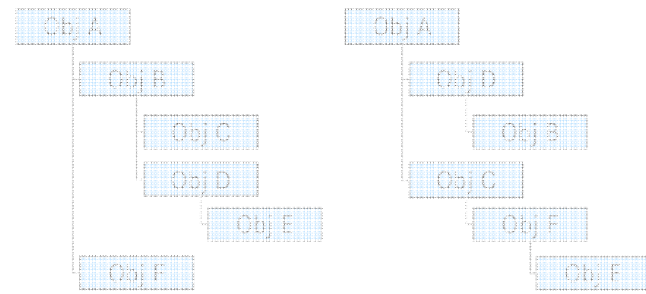


Different attribute names

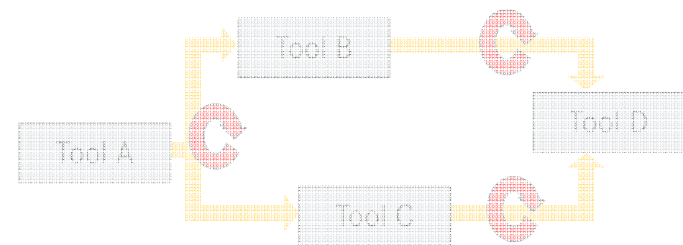


Different object type names

Object identification

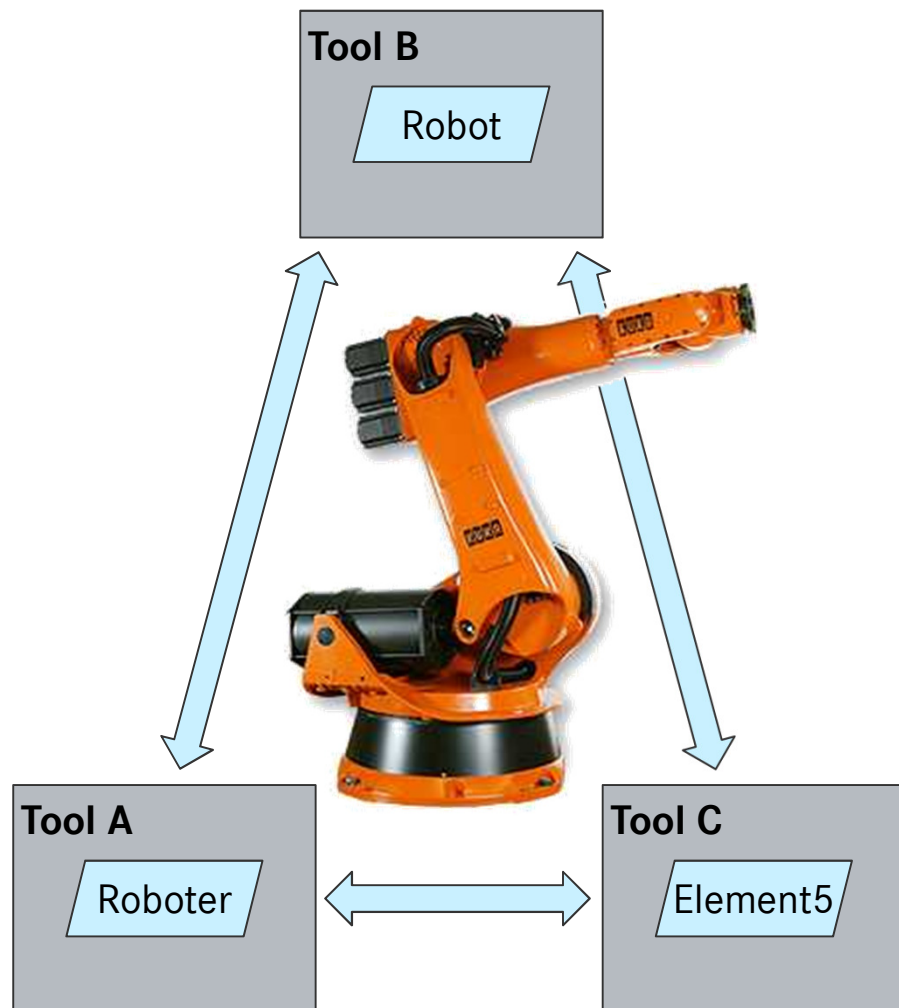


Different Topologies



Non sequential engineering processes

Challenge & Proposal: Different Object Type Names



Challenge:

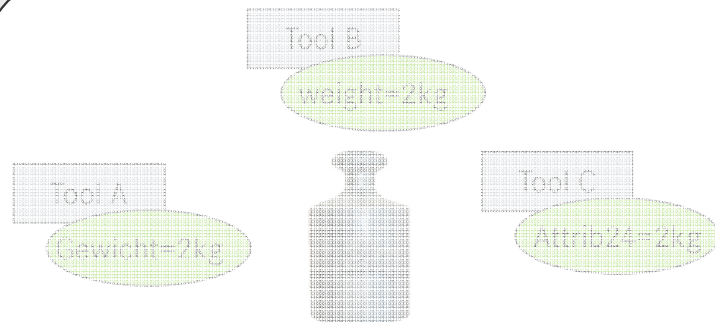
- Challenge related to attributes semantics
- Tools need to know the object semantics to handle the objects

Proposal:

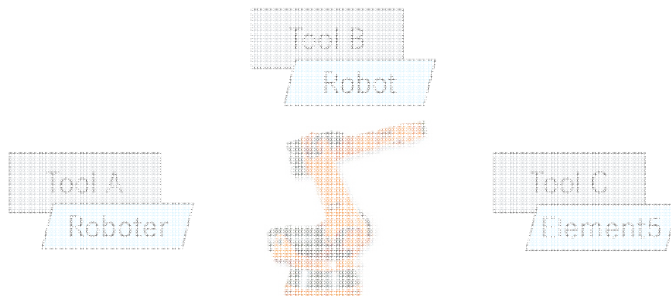
- Tools map their internal object semantics to RoleClassLibraries and SystemUnitClassLibraries

Some Challenges

Semantics

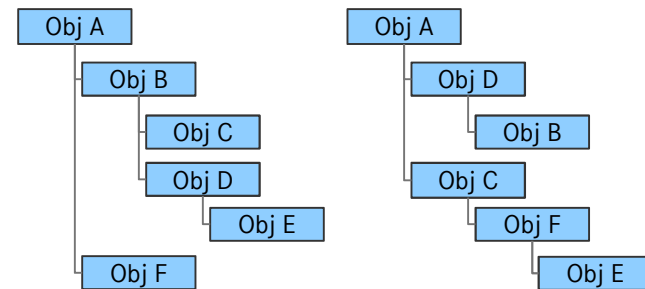


Different attribute names

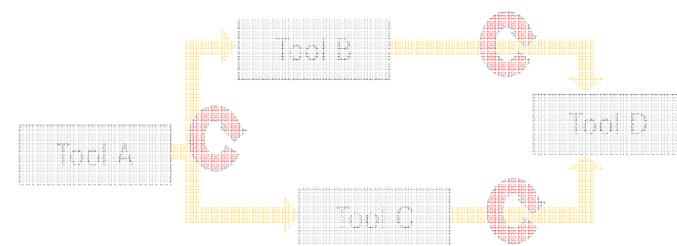


Different object type names

Object identification

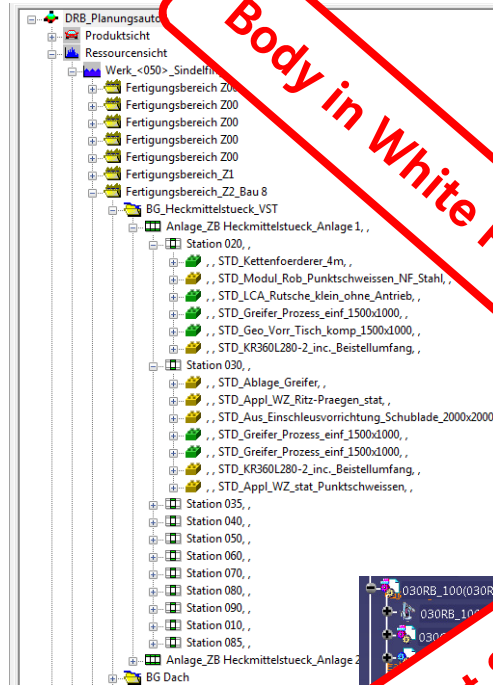


Different Topologies



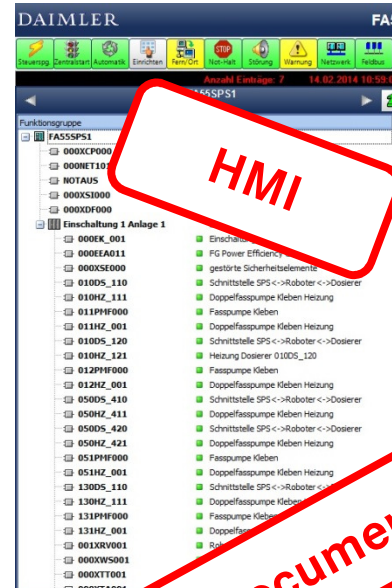
Non sequential engineering processes

Challenge: Different Topologies



Body in White Planning

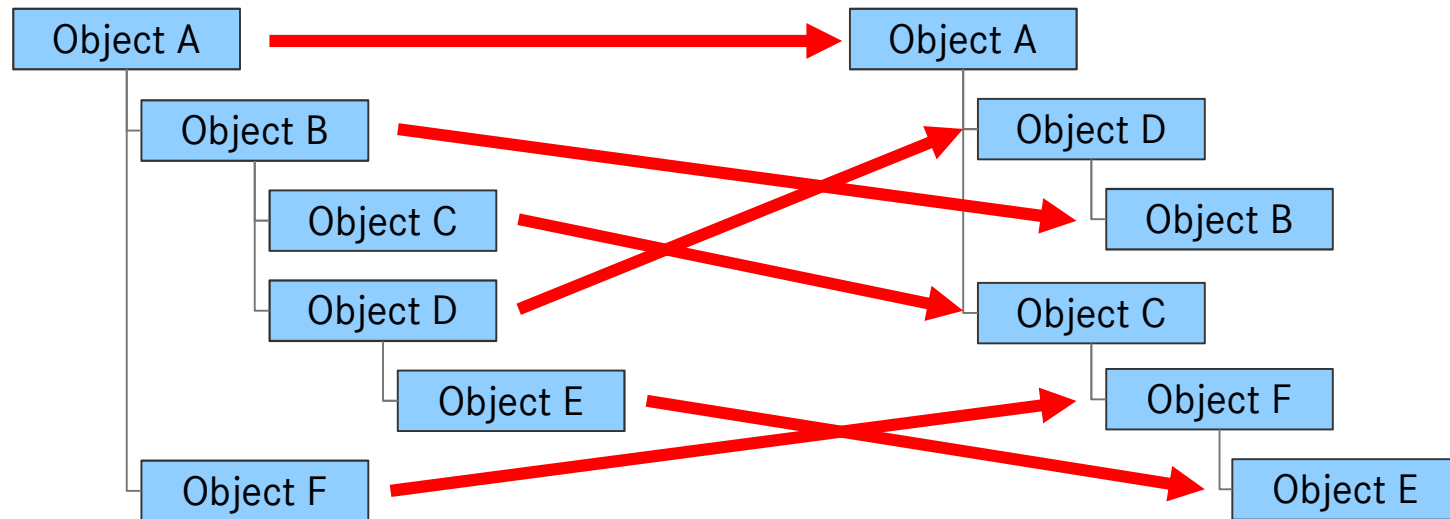
Robot Simulation



HMI

Line Documentation

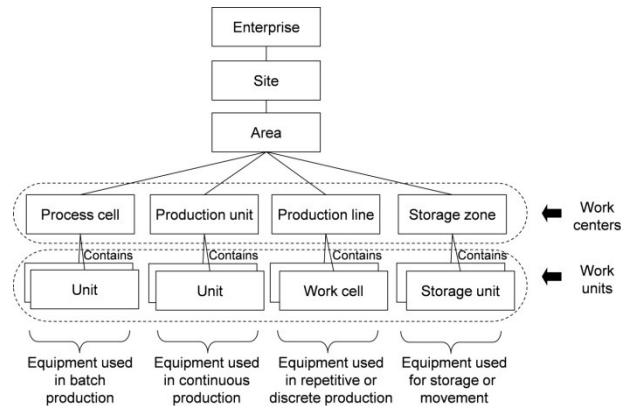
Challenge: Different Topologies



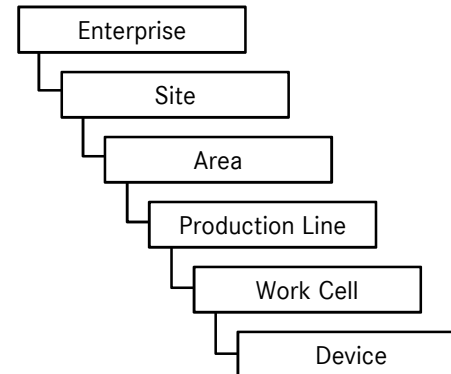
- Restructuring data with every data transfer and update
- Recalculation of position information
- Rearrangement of relations
- Mapping problems between tools

Proposal for Topologies

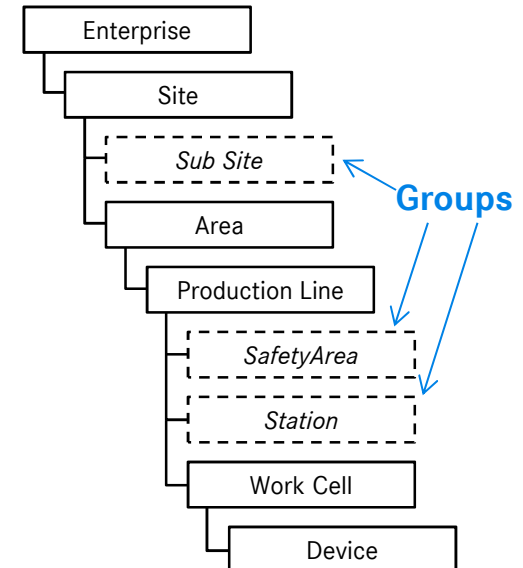
Structure according IEC 62264-1



Transfer to AML-Topology



Complemented Topology



Usage of Structure, e.g. according IEC62264-1 for topology for all engineering disciplines

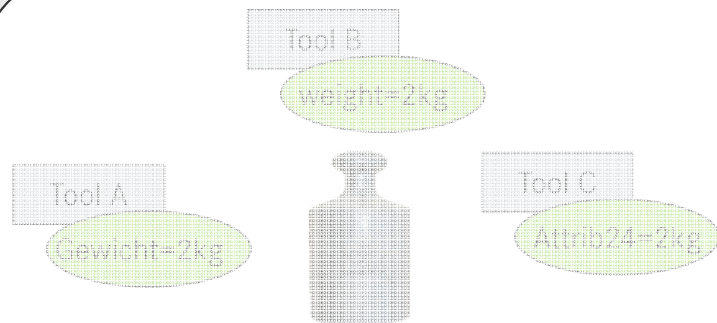
Complementation of topology with engineering discipline specific topology information using the AML group concept



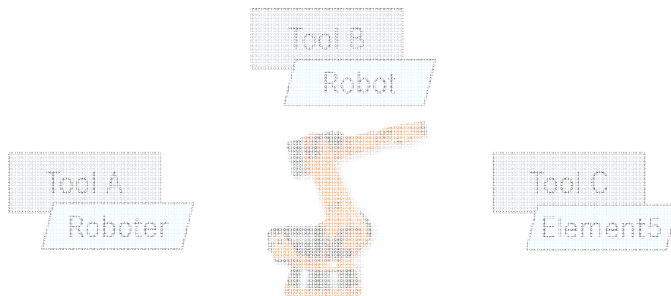
Enterprise specific standardisation of the topology over the whole engineering process

Some Challenges

Semantics

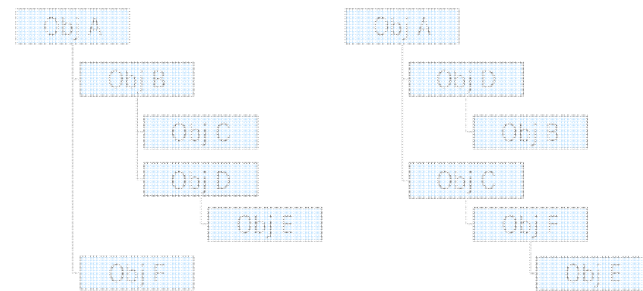


Different attribute names

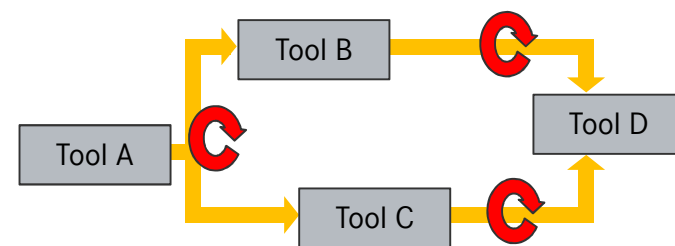


Different object type names

Object identification



Different Topologies



Non sequential engineering processes

Challenge: Non sequential engineering processes

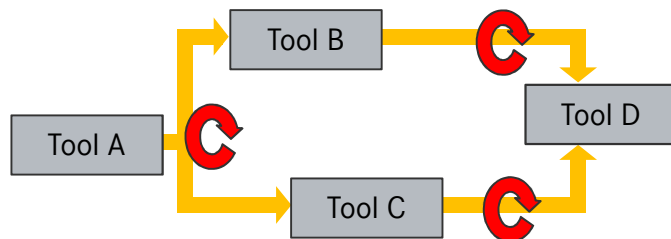
Sequential engineering process



Sequential engineering process with updates



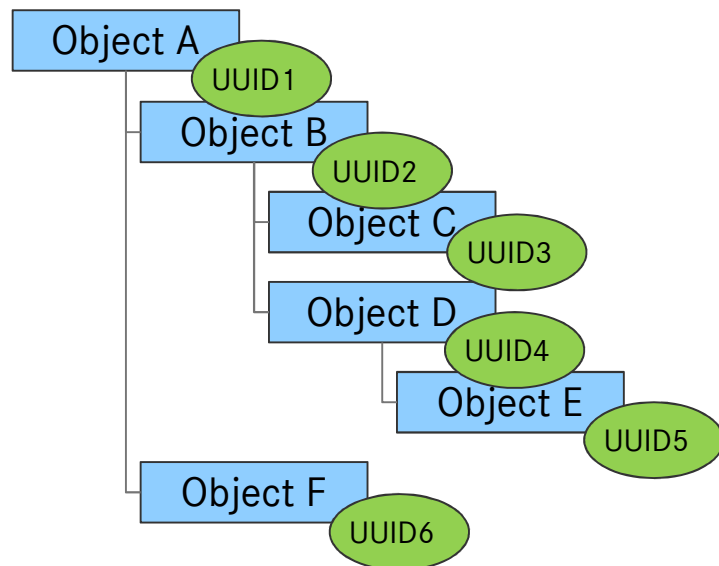
Parallel engineering processes



- Engineering processes are not sequential
- Data of pre-processes change and need to be updated
- Engineering processes are parallel, data flows are splitted and have to be merged

- Names and pathes are no suitable identification mechanism
- Assignment of the objects of the previous and the updated import
- Identification of concordant objects

Proposal for non sequential engineering processes



- Every object gets an UUID, which will not change over the life-time of the object



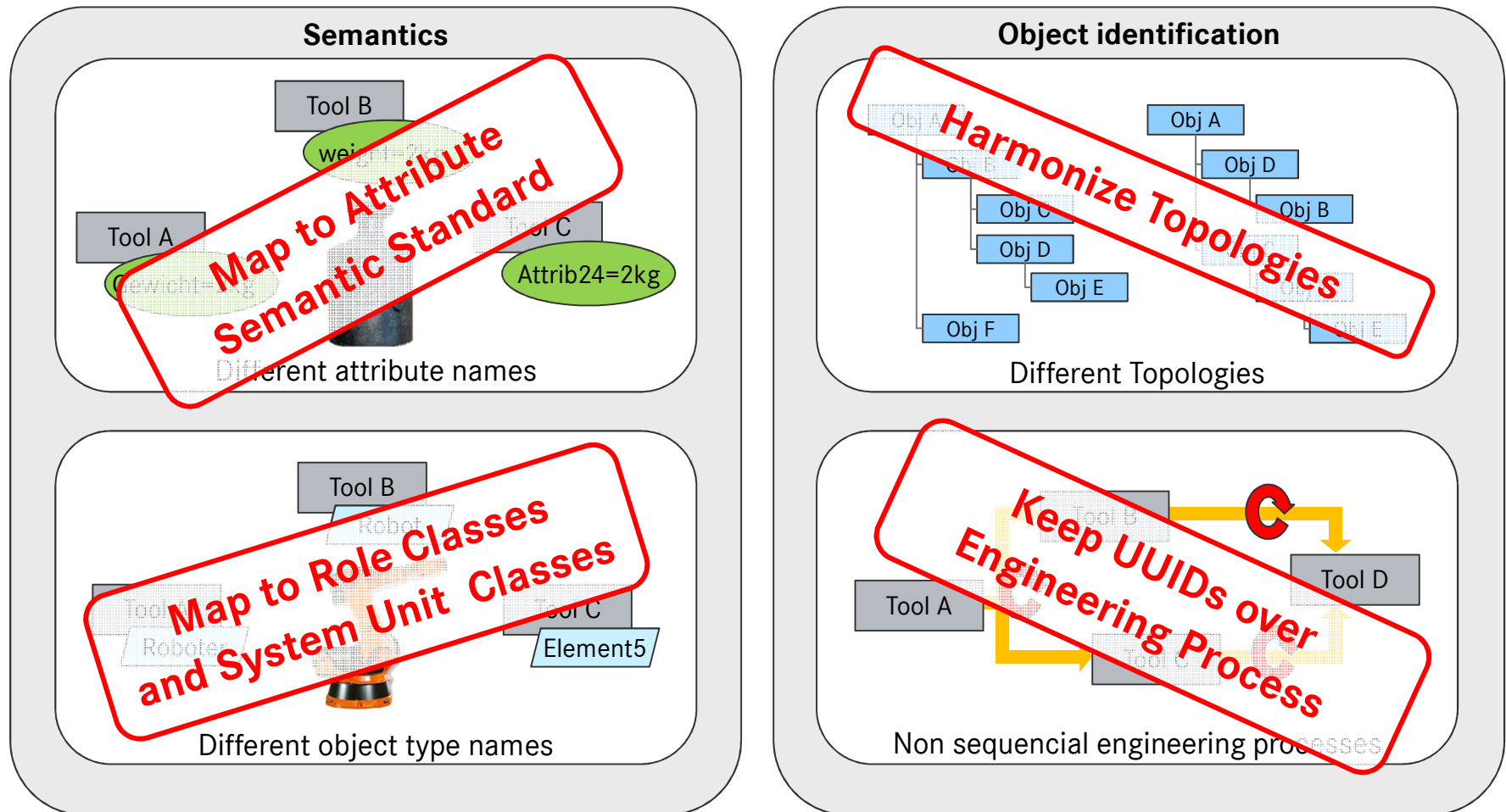
- Repeated exports of the same object leads to the same UUID.
- An object should keep its UUID after import in a tool and export.



- Engineering tools can identify the object even after several imports
- Merge processes are easier

Note: Tool specific IDs can also be stored with the object

Suggestions for Tools and Users in an Integrated Engineering-Workflow



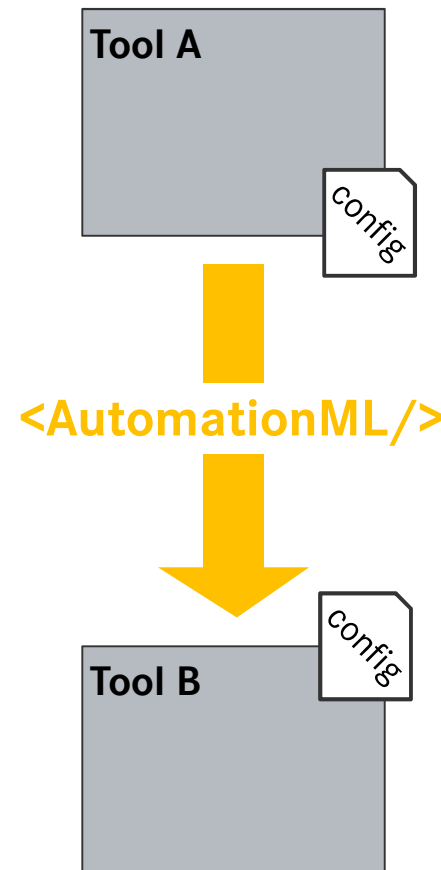
Suggestions for Tools, Exporters and Importers

Tools

- Storage of UUIDs of the objects
- Mapping of Topologies
- Usage of the group concept for further topology information

Importers and Exporters

- Mapping of attributes
- Mapping of objects to RC /SUC
 - from tool specific object semantics
 - with the aid of specific attributes
- As much as possible as variable configuration



Agenda

- Retrospective AML Conference 2012
- Example 1: Transfer of material data from material release list
- Example 2: Transfer of engineering data
- Example 3: Body in White Planning
- Challenges in a totally integrated engineering workflow
- Summary and outlook

Summary and Outlook

More and more interfaces are transferred to AutomationML.

Users discuss about

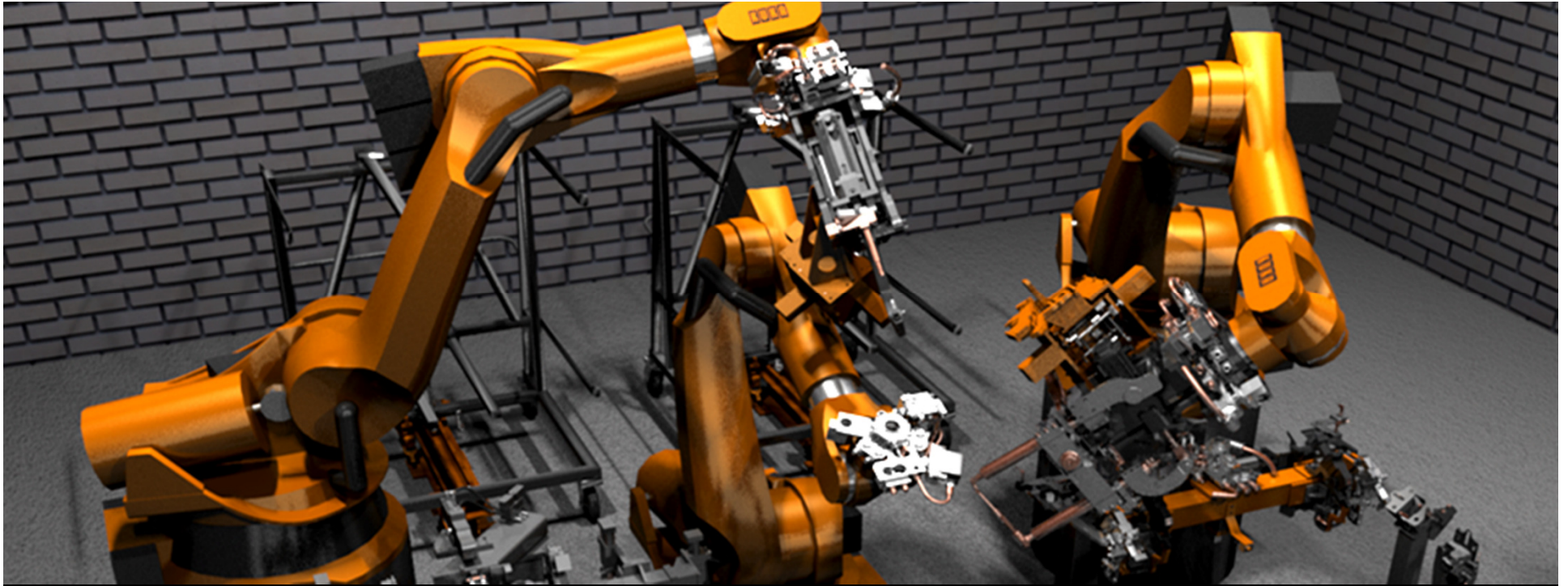
- data structures
- semantics for objects and attributes
- engineering scenarios

An incremental semantics standardization is possible with AutomationML.

The data format is only the first step ...

... the second step can be done in small increments.





Engineering Process with AutomationML

Björn Grimm
Joachim Burlein
TF/P3, Daimler AG

October 7th 2014



Mercedes-Benz