Industry 4.0 applications require new methods for designing simulation models. Using AutomationML plant models for designing virtual test-beds can reduce the development time by up to 40%.

Goal
Simulation models are used in various engineering disciplines. However, their design phase poses a time- and cost-consuming task, which limits simulation use and benefits in practice.

The goal is to make the design phase of simulation models efficient and fast. The main idea is to assemble a simulation model from simulation components semi-automatically according to an existing CAD description. The CAD schema is imported in the AutomationML format. Measurable criteria used for an evaluation are reductions of time and effort needed for the simulation design as well as reductions of design-time errors.

Solution Approach
The developed solution implements the following process:
1. The CAE/CAD data are represented in AutomationML as a generic input data format for the method.
2. The AutomationML file is processed by the AML Analyzer, developed at the CDL-Flex research laboratory.
3. Engineering data are combined with the description of available simulation components, their interfaces, and parameters.
4. The well-proven Bond-Graph theory is extended to reflect the current needs for computer-assisted design of component-based simulations.
5. The executable simulation model is generated in a process simulator.

When the real industrial plant is changed, the virtual simulation model can be re-generated easily. The use of AutomationML thus improves flexibility and re-use. Version control on all levels of the aforementioned workflow can guarantee traceability and efficiency.

Implementation
The prototype of the simulation generator was developed at the CDL-Flex research laboratory at TU Vienna. It was implemented in cooperation with the industrial partner CertiCon.

The implemented prototype proved that the time and effort needed for the design of simulation models can be reduced up to 40%. The approach also mitigates up to 50% of design-time errors.

The current version of the prototype is focused on the simulation model structure, but can be easily extended to support configuration of coupled simulations.

Technical Specification
- Modular service-oriented architecture implemented in Java.
- Data management with AML Analyzer and AutomationML Hub.
- Bond-Graph method and Matlab.

Benefits for Customers
- Simulation experts, control engineers, or quality assurance experts can share AutomationML files as a basic way for describing the structure of a real industrial system.
- Simulation models are semi-automatically generated from simulation components re-used among different projects.
- Effort and cost reduction for development and testing of simulation models and simulation execution.

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