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Simulation Platform and Co-Simulation
A Cloud-Native Approach

Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT | thyssenkrupp Transrapid GmbH, TechCenter Control Technology

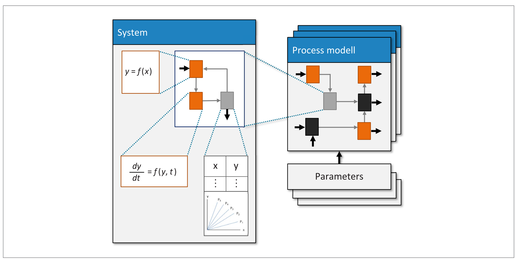
Fraunhofer thyssenkrupp

Objective

Process engineering system integration is generally understood as the composition of a complex overall system consisting of several technical subsystems. The actual construction of a process plant is often preceded by mathematical modeling and simulation of the overall system in order to eliminate design errors and risks in advance and to ensure proper operation within the operating parameters.

Strategy
Coupling of subsystems to process models

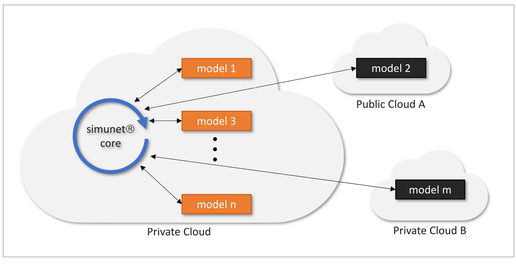
For the mathematical modeling of the overall system, the consideration of external, closed models is crucial, since suppliers often do not disclose the physically detailed mechanisms of action of their components. To analyze such coupled models, a special form of co-simulation has been used. This approach allows the embedding of black box models, while subsystem developers can analyze and optimize their own models in the overall context.



Aggregating components into systems and then into complex process models – a typical system integration task.

Solution process
Deploying models in the cloud

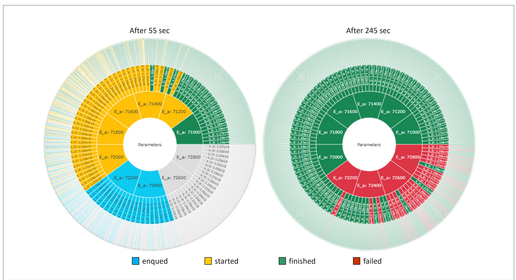
The simulation platform is based on a scalable, microservice-oriented, cloud-native compute backend. It provides a model registration component, a flowchart editor, components for configuring and executing individual simulations, and components for visualizing the calculation results. Parameters are varied using a scenario manager that allows easy configuration of value ranges and supports efficient computation of the resulting combinatorial variants.



Integrate remote black box models into the cloud native compute backend.

Results
Collecting the distributed simulation results

In the system integration task, complex scenario spaces are created by appropriate parameter variations. The more precisely this scenario space is explored, the more precisely the corridor can be determined in which a system concept can be operated economically. Using the co-simulation approach, the total computational complexity for D variants is reduced from approximately O(D) for sequential computation to ≈ O(1) for cloud-based parallel computation.



Visualization of the status of calculations.

A KEY BUILDING BLOCK FOR THE CLIMATE PROTECTION

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