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Structured Data Management and HPC: More Efficient Simulations with SCALE.sdm and GNS Systems for OpenFOAM

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CFD predictions, the testing of new medicines or the self-driving car - today, they are all based on the reliable processing of data. Increasingly powerful hardware, new sensor generations and more complex models for simulations are causing the associated data volume to grow enormously. The OpenFOAM software for the numerical solution of fluid mechanics problems (CFD) is also generating ever more extensive data, which are evaluated by diagrams and 3D models, for example. The efficient management of these huge amounts of data and the associated "lifting of the data treasure" in order to generate new efficiencies from confusing mountains of data and to establish compliance are currently among the greatest challenges for companies. Solutions must not only reduce data complexity, but also increase data competence to identify valuable information and patterns from the data volumes, which can be profitably used in the company.

In a joint presentation, SCALE and GNS Systems will give an insight into optimally structured data management in a concrete model project. The basis of the presented use case is the practical test results and data of a 3D Lego® airplane from GNS Systems in the Azure Cloud. The simulation of the complex Lego® model down to the smallest detail used scaling in the cloud to up to 8,000 cores to obtain detailed insights into lift, drag and rotational speed.

SCALE's powerful system solution for virtual product development addresses this data and provides an environment for end-to-end simulation data and process management.

The integrative software solution SCALE.sdm meets all challenges of transparency, documentation as well as collaboration of distributed and decentralized work and process standardization. The process of creating OpenFOAM simulations is automated to such an extent that, in addition to the Lego® aircraft from GNS Systems, any other simulation models can be easily created, or new configurations can be generated and simulated directly by manipulating the Lego® CAD data.

After all, automating complex simulation designs in favor of shorter runtimes on available cloud resources often remains a manual process, GNS Systems experts know. The methodology of continuous integration and continuous deployment (CI/CD) known from software development can also be transferred and applied to the OpenFOAM simulations of Lego® models. Companies benefit from the use of a CI/CD pipeline in virtual product development: maximum automation accelerates development processes and thus promotes faster time-to-market for innovations.

Simulations with OpenFOAM require innovative data management due to extensive data sets. SCALE and GNS Systems show with their concrete case study how the presented solution approaches establish a unique environment that addresses all aspects with regard to cost reduction, reliability as well as data consistency. Companies thus meet the general challenges in dealing with engineering data - for example data storage and management, optimal data access and traceability - in a future-oriented manner. They receive an environment that supports engineers in sustainably using all data from different sources and significantly reducing the required times between development, testing, and implementation.