

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 drugs 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 is 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 is currently one of the greatest challenges for companies. Solutions must not only reduce data complexity, but also increase data competence in order to recognise valuable information and patterns from the data volumes, which can be used profitably in the company.

The joint model project of SCALE and GNS Systems addresses these requirements. The approach presented in the lecture offers a solution for dealing with extensive data sets of OpenFOAM simulations with an integrated simulation data and process management as well as fully automated simulation workloads. The basis of the presented use case is the practical test results and data of a 3D Lego® aircraft from GNS Systems in the Azure Cloud. The detailed simulation of the complex Lego® model in OpenFOAM provided a broad data set on lift, drag and rotational speed. The integrative software solution SCALE.sdm provides an environment for continuous simulation data and process management for this data treasure. It offers engineers simple documentation and process standardisation in dealing with OpenFOAM simulations. The process is automated to the greatest possible extent so that, in addition to the Lego® aircraft from GNS Systems, any other simulation models can be easily built or new configurations can be created and simulated directly by manipulating the Lego® CAD data. For process automation, GNS Systems set up a CI/CD pipeline adapted to the simulation workloads. It minimises the manual work processes of complex simulation designs that often prevail in practice and accelerates the development processes in OpenFOAM.

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 approach establishes an 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 reducing the required times between development, testing and implementation.