Illustration of advanced simulation data management using LEGO® crash and CFD simulations **Fortgeschrittene Simulationsdatenverwaltung veranschaulicht anhand von LEGO® Crash- und CFD-Simulationen**		
Presenter (Name, Position, Company, Contact data)	Marko Thiele, Product Owner SCALE.sdm, SCALE GmbH, marko.thiele@scale.eu	
Additional Authors (Name, Contact data)		
Kurzfassung / Abstract (Text in English):		

AVL Deutschland GmbH
Peter-Sander-Straße 32
55252 Mainz-Kastel
Telefon +49 6134 7179-0, Telefax +49 6134 3588
E-Mail: entwicklungsmethodik@avl.com

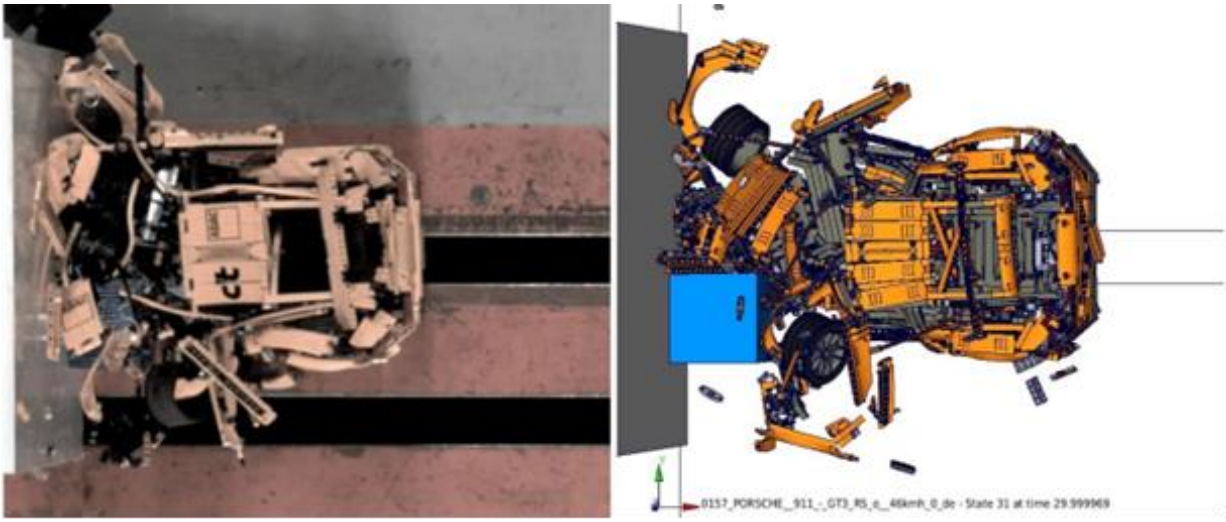
CAE processes are an integral part of virtual product development, as they allow the evaluation of product properties without the need for expensive physical prototypes. Setting up a continuous CAE process, which covers every aspect, is a complex task. This typically includes managing the requirements for the desired product, working with CAD data to create a virtual prototype, meshing the geometry to prepare for the finite element analysis, dealing with a multitude of sparse CAE solver files to create the actual simulation runs, submitting jobs to the HPC or the cloud to solve and then monitor the simulation runs, handling the result files, deriving key results and finally creating reports for the simulations.

In real-world vehicle development projects, where hundreds of experts must work and collaborate on such a process, this can be an overwhelming task. Simulation data management can be a key to enabling teams to overcome the challenges of these problems. To demonstrate the core principles of simulation data management, we looked for a more abstract, yet challenging simulation task to show what simulation data management is all about and how it can help to handle large amounts of data in a collaborative way and how automating processes can help create simulations on the fly.

Since we deal with highly sophisticated crash models on a daily basis in our professional lives, it seems obvious, that we instantly thought we should be able to simulate a crash of a LEGO® Technic Porsche Model using the LS-DYNA® FEM solver after seeing a video of a physical crash of this model on YouTube in 2017. However, after downloading the geometry files for these models, we realized that this would indeed be quite a challenging endeavor.

Real LEGO® models are often assembled from thousands of bricks, and handling so many parts in an SDM system on the one hand, and the ability to collaborate with multiple users on such models on the other, is a major challenge.

Initially, we set up the whole simulation process for the Porsche, which is composed of 2704 individual bricks.



However, when we presented the results to c't magazine, they challenged us to go even further and create a car-to-car crash simulation between the Bugatti and Porsche LEGO® models. After setting up these simulations in our demo environment, we began to extend this theme to other simulation disciplines, such as car-to-car crashes, CFD, water splashing, and even rendering. The goal of all this is to demonstrate the flexibility that modern simulation data management systems offer by handling all types of different simulation data and setting up arbitrary CAE processes. The LEGO® simulations are illustrative examples, but still a challenging and sufficiently complex use case for this showcase. Therefore, but also because playing with LEGO® is a lot of fun, we decided to use this as a challenge and benchmark.

In this presentation, we are going to show how an entire simulation process is set up in an SDM system and how the various aspects of the process are dealt with. This includes defining the requirements, handling the CAD models, meshing the geometry, automatically creating the simulation models, submitting jobs to an HPC system, extracting key results and presenting and reporting the results in relation to the original goals from the requirements.