New Developments in LoCo

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1 Introduction

DYNAmore GmbH has founded a new wholly-owned subsidiary known as SCALE GmbH. The aim behind this move is to offer software solutions and IT services for process and data management and for FE methods development in the automotive industry. In the past years, DYNAmore has created a variety of different software products under contract of AUDI. The reason for establishing SCALE GmbH is to further develop and market LoCo and other software products both within the Volkswagen group and beyond it as well. The name SCALE stands for "Scalable Solutions in Simulation Data and Process Management", solutions that can also be used as a shared platform with external development partners.

The core product for simulation and process data management is the innovative software solution LoCo. LoCo is being intensively used at many different simulation units, with currently over 500 users at Audi and at a large number of contracted service providers. LoCo is also being phased in at other brand divisions of the Volkswagen group.

LoCo applies several new approaches to Simulation Data Management, such as strict offline capabilities with permanent synchronization of relevant data, consequent version management of all involved objects by means of simulation models and processes, novel ontology based approaches for the assembly of components as well as easy customizability. LoCo is an open system for the integration of any third party or in-house CAE-product, such as pre-/post processors, FE-solvers, queuing systems, process scripts, etc.
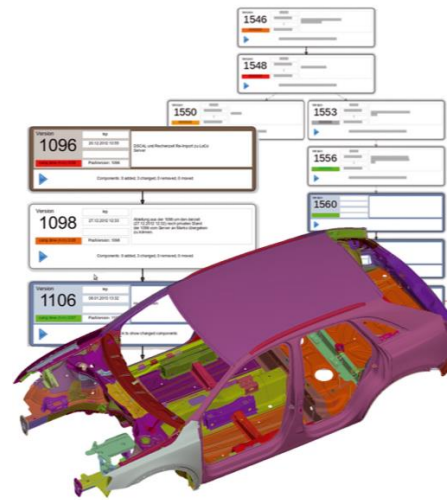
2 New Developments in LoCo

The rapidly growing of the user and customer base of LoCo in the past years have led to many additional requirements and new ideas, and consequently to the implementation of new features and concepts. The main focus in the further development of LoCo is to provide a solution which meets best possible all customer requirements and simultaneously keep excellent usability and performance. In the following, already completed features and ongoing developments are listed.

2.1 Completed Features

- **Completion of the check infrastructure:** Now there are several ways in which users can setup the check infrastructure. New is the possibility to use the solver locally to perform a data check right after modification of include files. This greatly increases the respond time for correcting errors. Engineers are getting notified instantly about errors in their decks an can open the corresponding files right away at the line where the error occurred. On the other hand we introduced functionality where the checks can be done as part of the solving step right before execution on HPC resources. This allows a constant monitoring of the quality of simulation data and measures can be taken in order to prevent users from using faulty decks that might lead to misleading results or excessive use of HPC resources.
- **Multi process support:** In order to increase the overall performance of the LoCo rich client now several tasks that are run by LoCo in the background are separated to individual processes each using its own core. By putting the synchronization, the assembly and submit, as well as caching of run objects to dedicated cores of a machine, users can keep having a fluent user experience while working with the GUI.

- **Multi run setups:** Users are now able to easily setup configurations in LoCo where multiple runs with slightly varying setups have to be performed. [1][1]
- **Advanced searched:** The whole LoCo database can be searched locally and while being offline. Users can search by various properties and combine them to find the desired model data.
- **Preprocessor components:** LoCo now supports the handling of model components in native preprocessor formats such as ANSA database files or Medina BIF files.
- **Copy'n'Paste:** Throughout the whole application the standard mechanisms for Copy'n'Paste such as short cuts or context menu actions, can be used to move data from one point to another.
- **Refactoring of various GUI components:** Various GUI components such as the parameter tables, the assembly dialog and the dialogs for the history comments have been refactored to adapt them to the current needs of the engineers.
- **Import/Export for integrating offline users:** Through this functionality it is now possible to integrate users that are not connected to the network where the LoCo-Server resides. The offline users can still work in the same environment within LoCo just like regular users and their progress is seamlessly integrated into the central LoCo-database by importing their data when it's ready.

2.2 Features in Development

- **Encryption for local database:** The encryption of the locally stored includes has been implemented in LoCo since about 2013. This functionality will be completed by extending it to also encrypt the locally used sqlite database. The encryption can be performed by using smart cards allowing for two factor encryption.
- **Data deduplication**: Applying this new compression technology, developed as part of the ongoing VAVID project [3], LoCo will be able to cut down the storage and bandwidth requirements by another factor of 6-8 compared to the actual implementation. Related to uncompressed data this is a factor of compression of about 20-25.
- **Support for SDM-Zip:** In cooperation with SIDACT and AUDI new compression techniques are investigated leading to higher compression factors of about 2-3 for simulation output data compared to actual FEMZIP implementations.

2.3 Features on the Roadmap

- **Reducing the visibility:** In order to achieve that using LoCo becomes easier for engineers to be used in big setups with many disciplines, KeyUsers will be enabled to configure what exactly is visible for certain groups of end users.
- **Multi stage setups:** Through this feature user will be able to create setups in which they can reference to the runs of other teams to include their results. This way, for example, it will be possible to include the output of an airbag folding simulation (folded airbag) into another setup for designing a restraint system.
- **Simple client:** Using a whole new GUI-Framework the next generation of LoCo will be started by implementing a simple client. This client will be much easier to use and focus on the core functionality of LoCo while keeping compatible with current data.

3 Literature

[1]   Richard Luijkx: "Using LoCo for Multi Run Simulations", 10th European LS-DYNA Conference, Würzburg, Germany
[2]   Wikipedia: "Continuous Integration", http://en.wikipedia.org/wiki/Continuous_integration
[3]   VAVID - BMBF Big Data research program, http://www.pt-it.pt-dlr.de/de/3138.php
[4]   Meister, D., Kaiser, J., Brinkmann, A., Cortes, T., Kuhn, M., & Kunkel, J. (2012, November). A study on data deduplication in HPC storage systems. In Proceedings of the Int. Conf. on High Perf. Computing, Networking, Storage and Analysis (p. 7). IEEE Computer Society Press.
[5]   He, Q., Li, Z., & Zhang, X. (2010, October). Data deduplication techniques. In Future Information Technology and Management Engineering (FITME), 2010 Int. Conf. on Future Information Technology and Management Engineering (FITME) (Vol. 1, pp. 430-433). IEEE.

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[1] Please consider attending the presentation of Richard Luijkx on the topic „Using LoCo for Multi Run Simulations" [1]