LoCo - An Innovative Process and Team Data Management Solution for Simulation

Marko Thiele[1], Torsten Landschoff[1], Andreas Johann Beck[2]

[1]SCALE GmbH, [2]AUDI AG

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.

Figure 1: History graph of a body and white model

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 about 650 registered and approx. 350 active users per month 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.
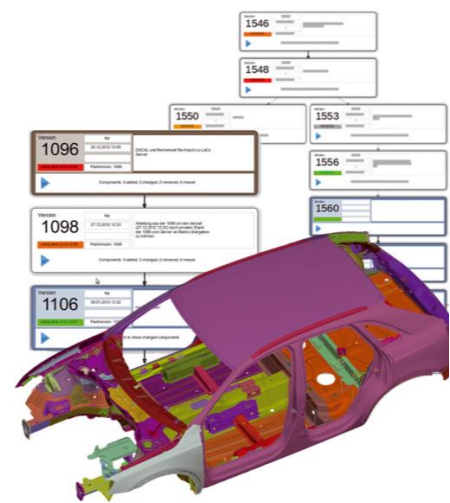
2 Classification and Characteristics

2.1 Classification of LoCo

LoCo is a module of the SCALE SDM product portfolio. It is designed for the management of simulation input models including all the associated processes.

The lineup of SCALE includes several products and supports the entire lifecycle of the typical CAE design workflow:

- **CadMe** - Support of meshing processes and data interface CAD/CAE
- **LoCo** - Solution for simulation data and process management
- **CAViT** - Integrated post data management system for tests and simulations
- **Status.E** - Monitoring of design process for product development

Figure 2 shows the arrangement of the individual SCALE products in the CAE development process. On customer request the software modules can be individually combined or integrated as desired.

SCALE Products
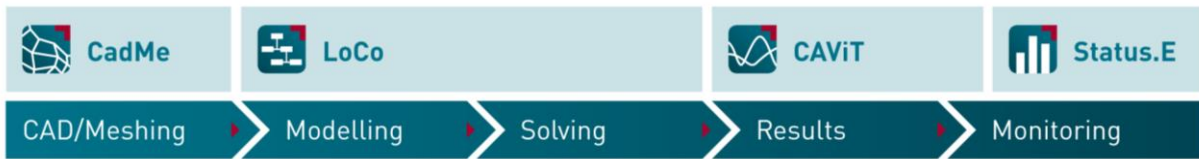for Management of CAE Design Process

Figure 2 Overview of SCALE products for CAE design process

2.2 Characteristics of LoCo

LoCo offers users a perfect working environment for daily tasks of simulation engineers, see Figure 3. Access to simulation and process data is easy. There are no limitations on sharing model data or related documentation – either within your company or with your business partners. Sophisticated role-based access management and high security features ensure confidentiality.
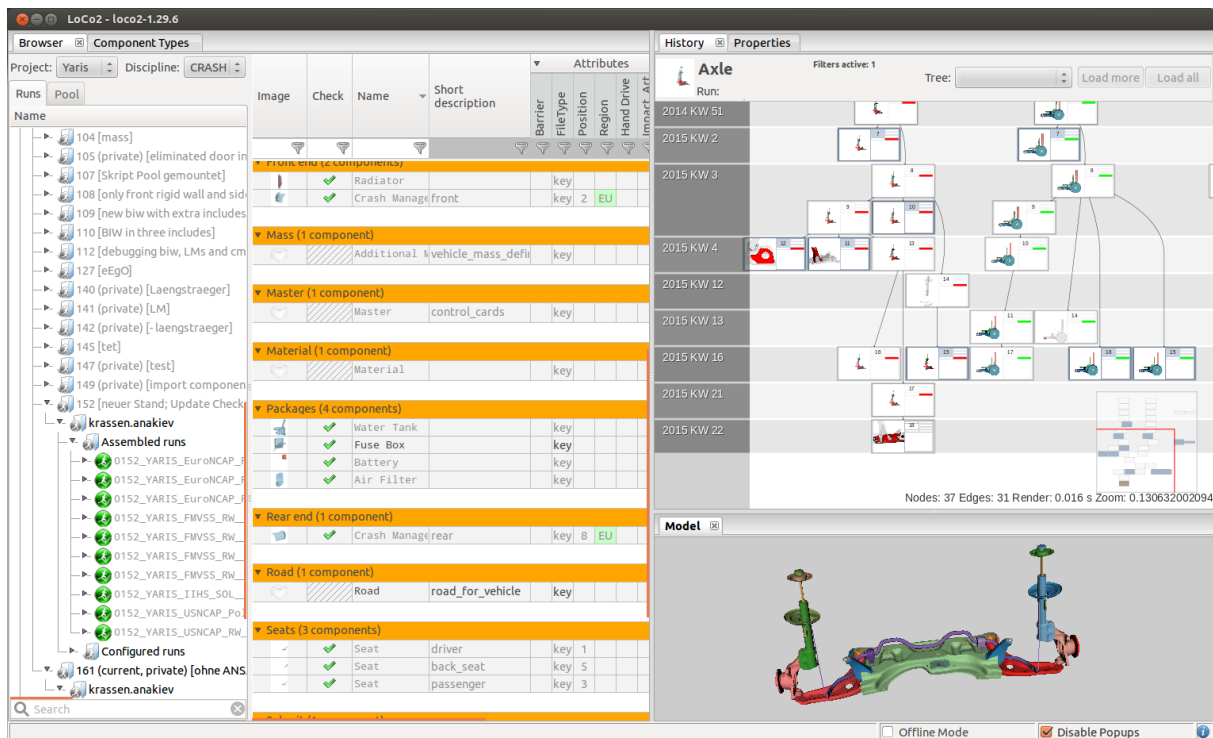

Figure 3: LoCo user interface - workbench for simulation engineers

LoCo applies several new approaches to simulation data and process management, such as strict offline capabilities with permanent synchronization of relevant data, consistent version management of all objects involved by means of simulation models and processes, novel ontology-based approaches for component assembly, and 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.

Summary of key features of LoCo:

- Unique rich client/offline architecture with advanced synchronization technology
- Quality check of simulation models

- Complete documentation and visualization of development history
- Extensive version management of all data objects
- Open system for integrating any third-party application
- Integration of optimization, design of experiments (DOE) and robustness studies
- Data security: strong authentication and encryption
- Latest technologies for data compression
- Advanced and flexible role-based access management
- Extensive configuration and customization capabilities
- Collaborative development at distributed locations with shared FEM models
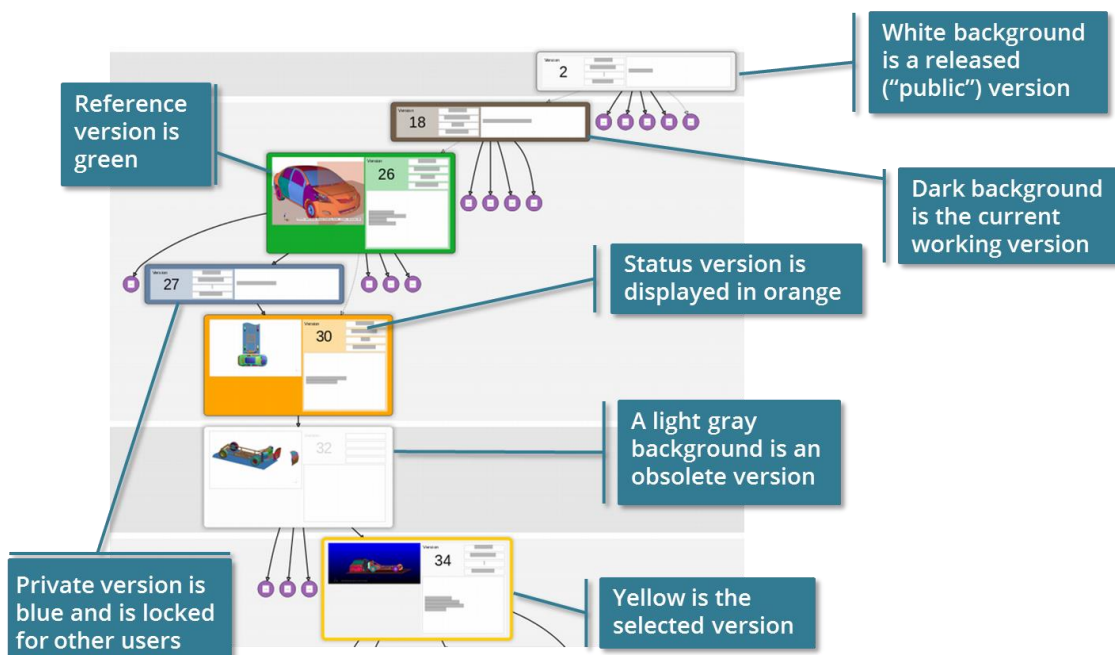- Integration of CAE processes and solvers
- Model and load case assembly

Figure 4: History graph with comments that explain the meaning of the colors

3 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.

3.1 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 input 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]
- **Advanced search:** 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.

3.2 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 SDMzip:** 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.
- **Multi stage setups:** Through this feature users 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.

3.3 Features on the Roadmap

- **Configurable views:** In order to achieve that using LoCo becomes easier for engineers in big setups with many disciplines, Key-Users will be enabled to configure specific views for certain groups of users.
- **New client:** On the basis of a new GUI-Framework, the next generation of LoCo will be introduced by the development of a new client. This client will be much easier to use due to providing only functionality of LoCo that is needed by the specific user.

4 Literature

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