CAE DATA & PROCESS MANAGEMENT WITH ANSA

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TECHNICAL PAPER

CAE Data & Process Management with Ansa

1. Introduction

Data Management is unquestionably one of the most critical factors contributing to the efficiency and productivity of CAE. At Volvo Group, the CAE process have been structured and streamlined to support the design evolution of new products using Ansa DM. Therefore, to increase the CAE efficiency, productivity & Lead Time Reduction (LTR) during product development, an automatic interaction with PDM and CAE software (Enovia – Ansa) has been established by Ansa DM techniques.

A link has been developed which has a robust capability to read the CAD data & attributes automatically into CAE software, perform translation, mid-surface and batch meshing for different disciplines (Crash / Durability / NVH) simultaneously . It is “Fully Automatic”. The development is called “ENOVIA-2-ANSA”

Furthermore, a new method for CAE model set-up has been developed using “Ansa-DM” archival capabilities. Include files are stored in an organized way, creating a global reference library. This procedure answers many current challenges like data organization, collaboration, and decision making. Similar to Enovia, “Ansa-DM” is a PDM “like” system for CAE development process.

Finally, a central data repository has been established for data exchange across the two sites of Volvo in Bangalore and Gothenburg.

2. Ansa DM: why & how

2.1 Why Ansa DM

- To increase the efficiency and productivity of CAE, during design evolution & LTR
- For flexible & inexpensive solutions that can bridge the gap between design, PDM systems & CAE
- Create a reference point for all CAE verifications

2.2 How

- Automatic interaction with PDM / PLM systems
- Automatic CAD input techniques
- Batch FE meshing
- Representation Management (Switch Disciplines) for parts and includes
- Auto compare geometry, connections & solver specific definitions
- Update notifications related to model in hand and new CAD & connections
- "CAE – PDM" like system for data browsing during development process

3. Current Challenges Vs Ansa DM solution:

In today's CAE world, often most of us come across many typical challenges and questions to deal with CAE data. How the data should be organized, collaboration with multiple users, deciding on the status of the data and so on. Ansa DM has complete solution for the few challenges quoted above. Ansa DM has wide range of features and benefits to deal with. It is a robust tool to manage CAE data & perform state of the art FE model set up. The tool is simple and cost effective.

Going further, we will see more in detail on Ansa DM capabilities

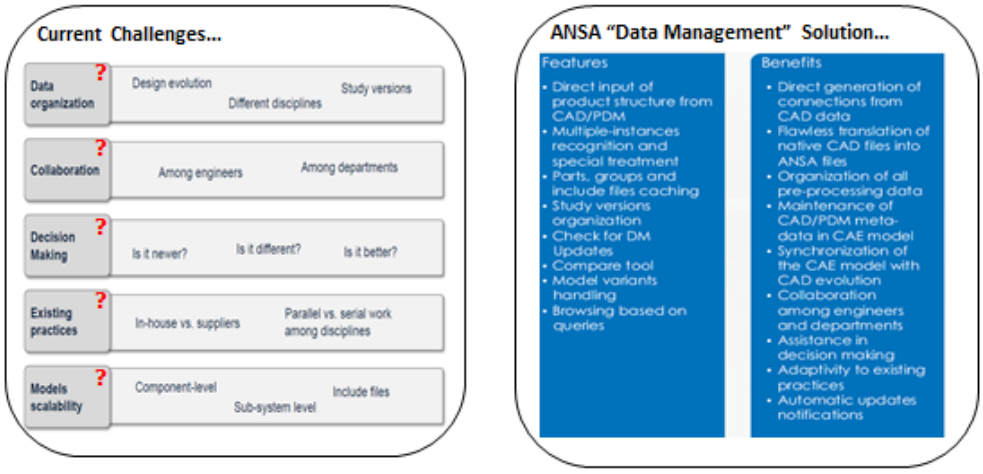


Figure 1: Current Challenges Vs Ansa DM capabilities

4. Ansa Data Management (DM)

ANSA Data Management (ANSA DM) is a centralized, file-based, data management system, used to collect and store in a structured and hierarchical form all engineering data that are used during the development process of a vehicle simulation model.
Under ANSA DM, all engineering data are stored in the same physical location. This location is made known to ANSA, so that all communication related to the storage and retrieval of engineering data and their updates is managed automatically.

The engineering data stored in our case:

- Part and sub-system data: The geometric representation of parts as ANSA files and of sub-systems as include-files
- Library Items: Connector entities custom representation files

5. Enovia-2-Ansa

To increase the CAE efficiency during product development, an automatic interaction with PDM and CAE software (Enovia – Ansa) has been established by Ansa DM techniques.

5.1 User Script

- This function reads the product structure information exported from Enovia as a tree in the Parts Manager and translates the CAD files referenced in the product structure.
- Additionally, the function can generate the "common" representation of the parts by extracting the mid-surface or offsetting the faces to the neutral fibre and also
- create meshed representations, for the mesh specifications available in DM:/batch_mesh_sessions

After each phase, the parts are saved in DM with the following representations:

- translated cad: The CAD translation result, with no geometric modification
- common: The clean geometry of the part after automated mid-surface extraction (for stamped parts only) or after offset of faces
- mesh representations: The meshed representations of the parts for which a "common" representation was either generated or pre-existed

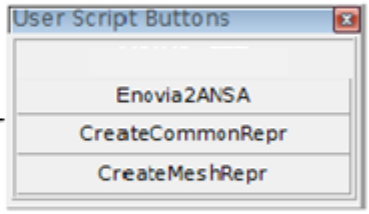


Figure 2: Enovia-2-Ansa User Script

5.2 Graphic User Interface – GUI

Current DM: the project DM root

Working dir: where the CATIA and attribute files reside

Extraction Log: ExtractionLog.xml (exported from Enovia)

Structure XML: One or more xml files describing the grouping of parts in the structure (exported from Enovia)

Filter tree structure before importing: When active, the *Product Tree Editor* window will pop-up for product structure preview and filtering. Otherwise, all referenced parts will be processed

Stop after importing tree structure: When active, the process stops right after importing the tree structure in the Parts Manager and no CAD translation takes place

BoM list for offset: CSV file for the definition of offset directions for the parts with open shell geometric description (optional)

Mesh parts: When active, parts will be meshed according to the activated *mesh types*. Note that the listed mesh types are those found in the current DM.

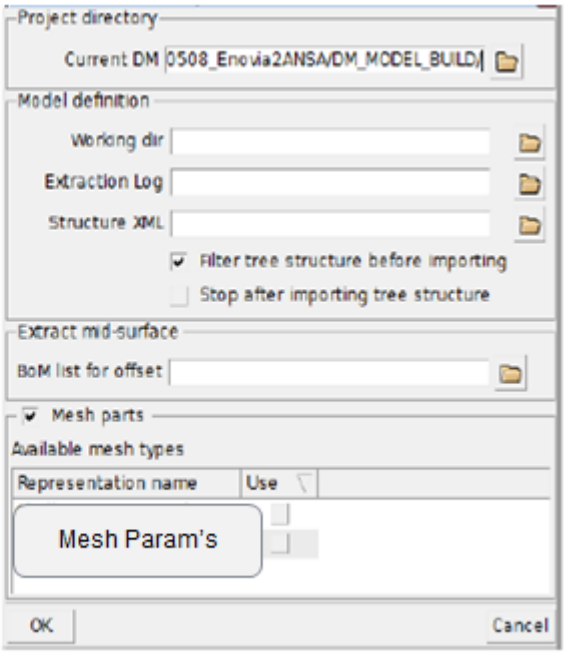


Figure 3: Enovia-2Ansa Graphic User Interface (GUI) & Inputs

5.3 Process Flow Chart

Below is the process flow chart for Enovia-2-Ansa script execution

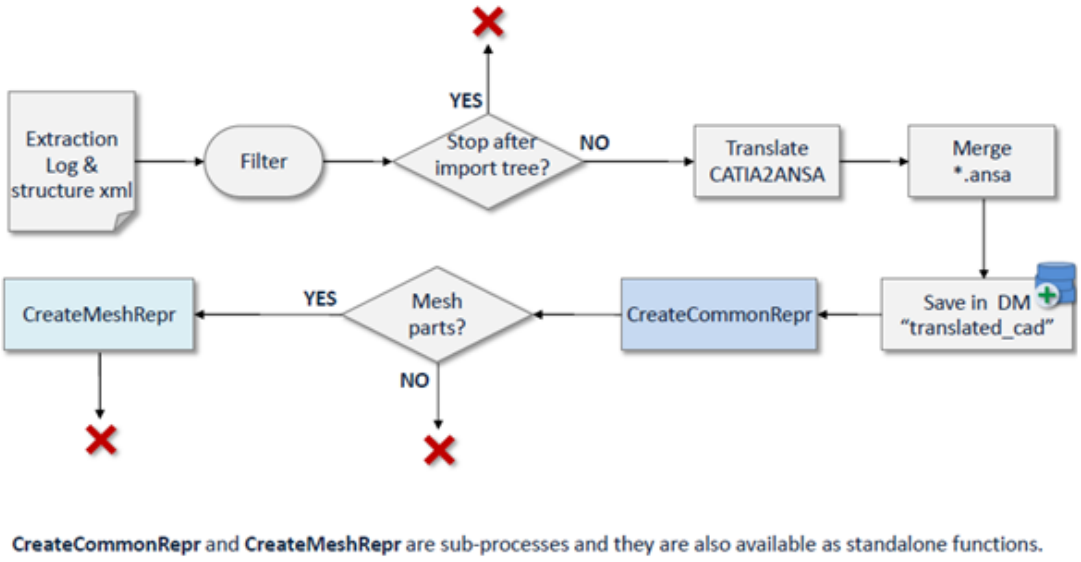


Figure 4: Enovia-2-Ansa Process Flow Chart

5.4 Additional Functions

Apart from Enovia-2-Ansa, there are two other additional functions developed for the ease of parts representation management.

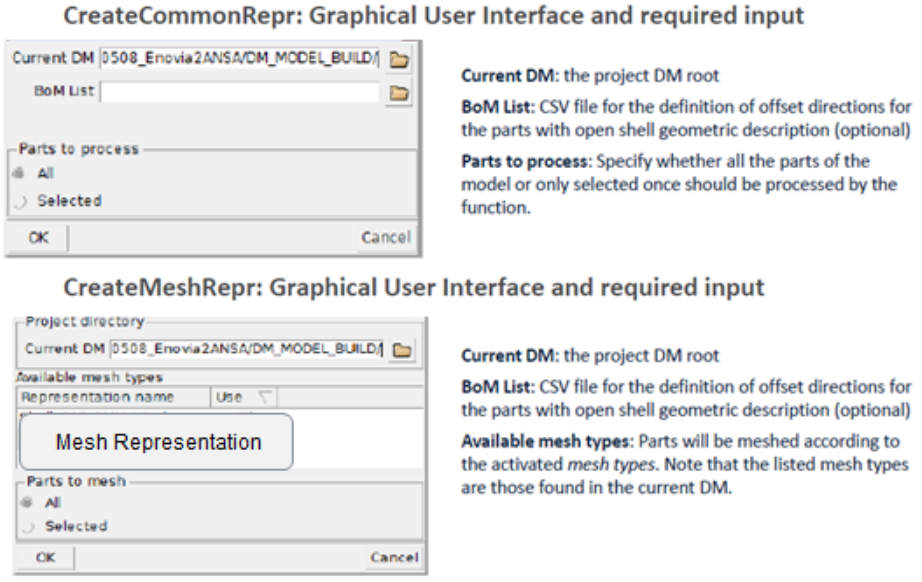


Figure 5: Enovia-2-Ansa Additional functions

5.5 Results

The Enovia-2-Ansa process generates two interesting results.

1. Process Log, describing the status of each process phase
2. Assembly Log, summarizing the progress status per part in the Parts Manager of ANSA

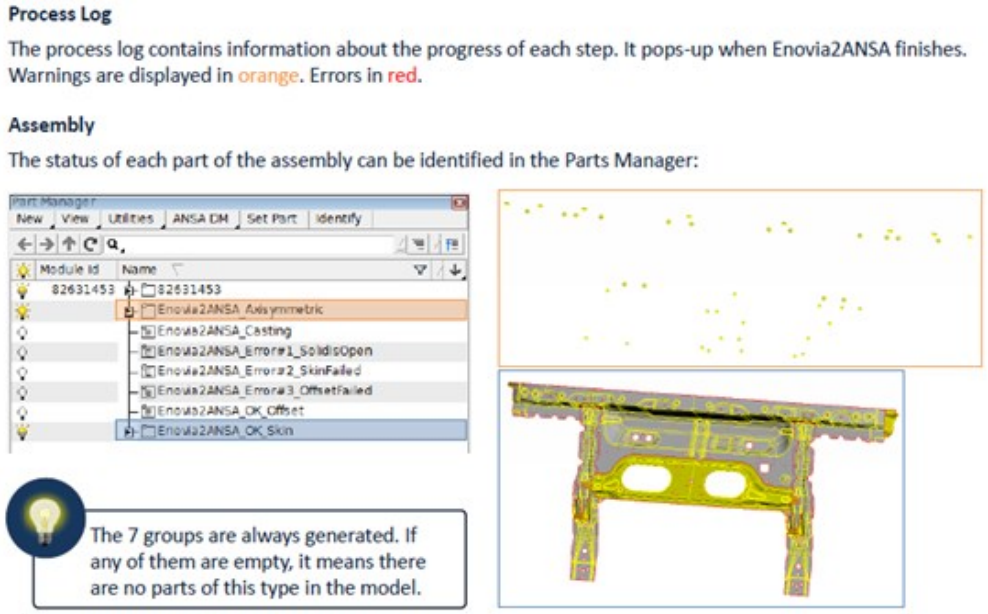
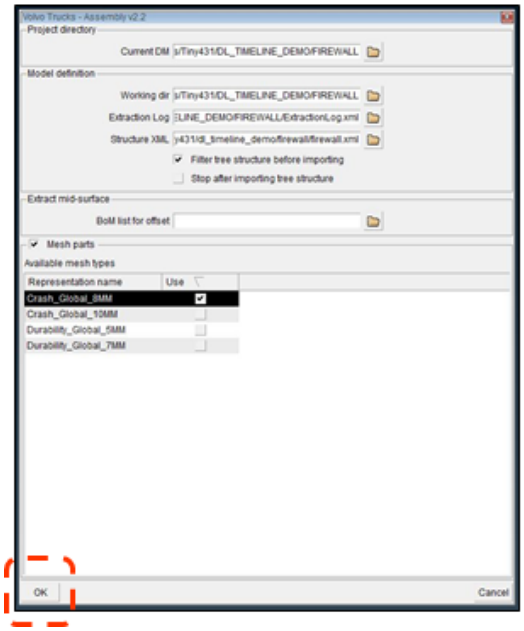


Figure 6: Enovia-2-Ansa Results Log

6. Usage of Ansa DM

6.1 Use case 1: Creating a pool of mesh representations for parts with Enovia-2-Ansa



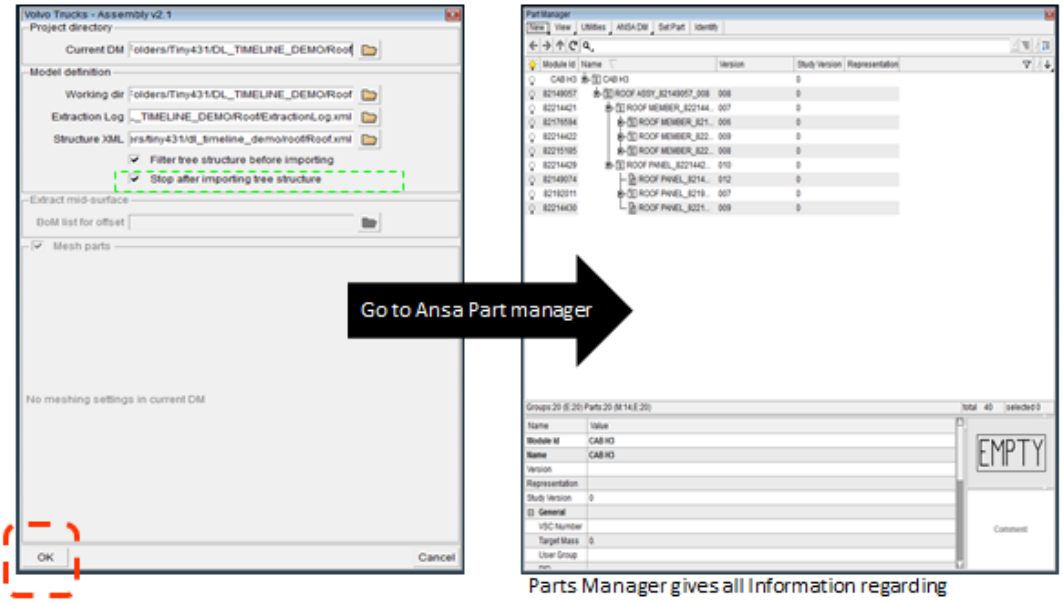
Inputs

1. Define Project Dir (DM Root)
2. Define Model Definition
3. Toggle OFF "Stop after importing Tree structure
4. Toggle ON mesh Parts
5. Select Mesh representation for required discipline
6. Say OK !

Outputs

1. Catia to ansa Translation
2. Mid surface extraction
3. Mid surface CAD as translated CAD in DM
4. Meshed parts saved as representation (Dura, Crash)

6.1.1 Enovia-2-Ansa Output



Below are the products of the Enovia-2-Ansa process

- “translated cad” representation for all parts, representing the exact result of the CATIA to ANSA translation
- “common” representation for all the parts, representing the geometry representation to be used for meshing (skin of parts at the neutral fibre after mid-surface extraction or offset of faces)
- Alternative mesh representations for all the parts, according to a library of mesh specifications

6.1.2 Representation Management

Different representations can be created and stored, facilitating the use of components in multiple disciplines like Crash, Durability, and NVH etc. The user can automatically switch between the translated CAD and other FE representations as per the need.

Each representation can accept an arbitrary number of “Study Versions” as and when there is an update in the design of the component on FE model level. Ansa DM has the option to “reload” the FE model from any discipline at any point of time by the user. Ansa DM will pull the relevant model for further updates and modification. See figure-7

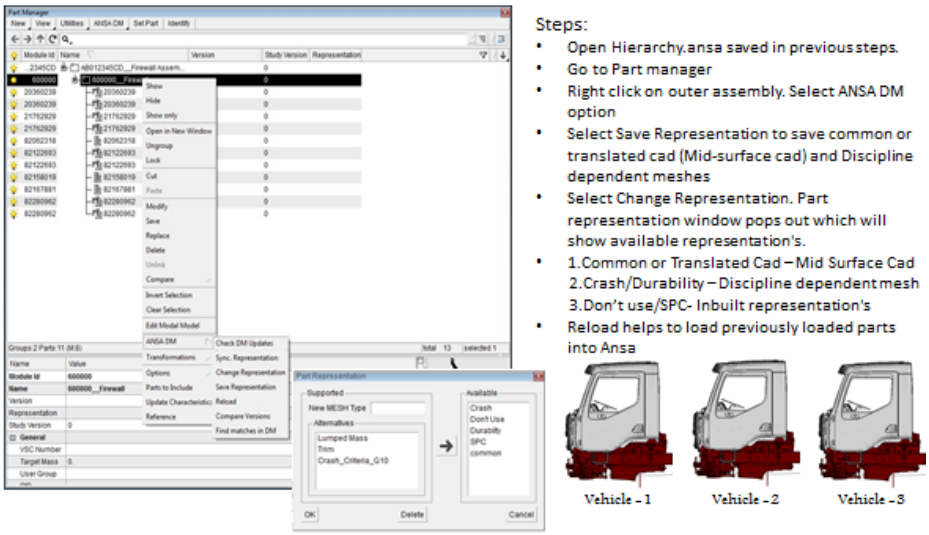


Figure 7: Change Representation

6.2 Use case 2: Includes management and assembly

ANSA Data Management can handle include definitions in the same manner as it does with parts and groups. Include files in ANSA DM acquire a unique identification number, version, study version and representation.

Include files can be added in the ANSA DM pool either with direct "output" from ANSA with "Save Representation" or with after a file-system "copy" action, maintaining the integrity of the original files. See figure-8.

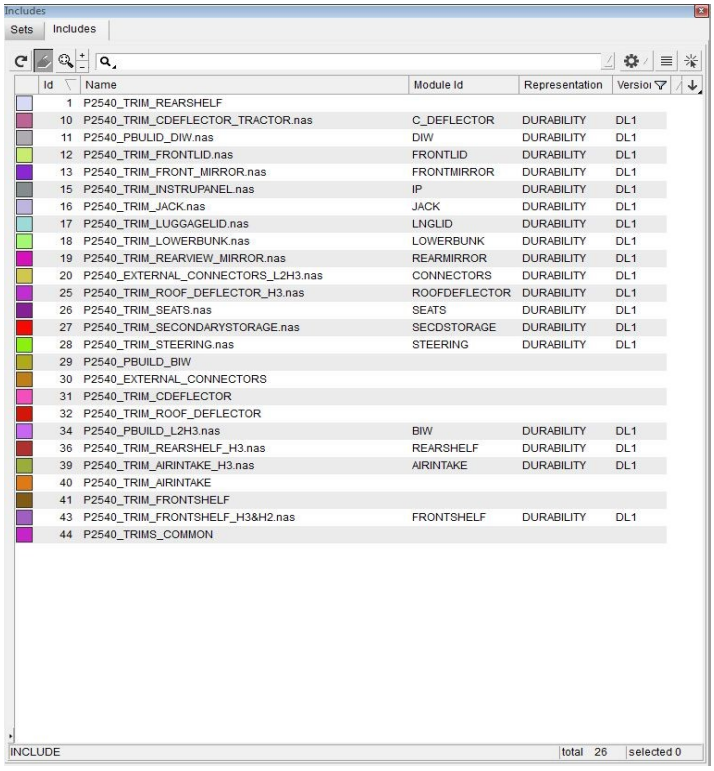


Figure 8: Include Preparation

In the above figure-8, we see an example of Include preparation for Durability. Similarly Includes are prepared for other disciplines like Crash with Radioss and LS-Dyna and durability with Nastran.

6.2.1 Includes Matrix

Having created a pool of includes files in Ansa DM, different cabin configurations can be set-up in the Includes Manager in the form of an includes-configurations table. Through this tool, any cabin configuration can be loaded in ANSA for assembly, or can be exported.

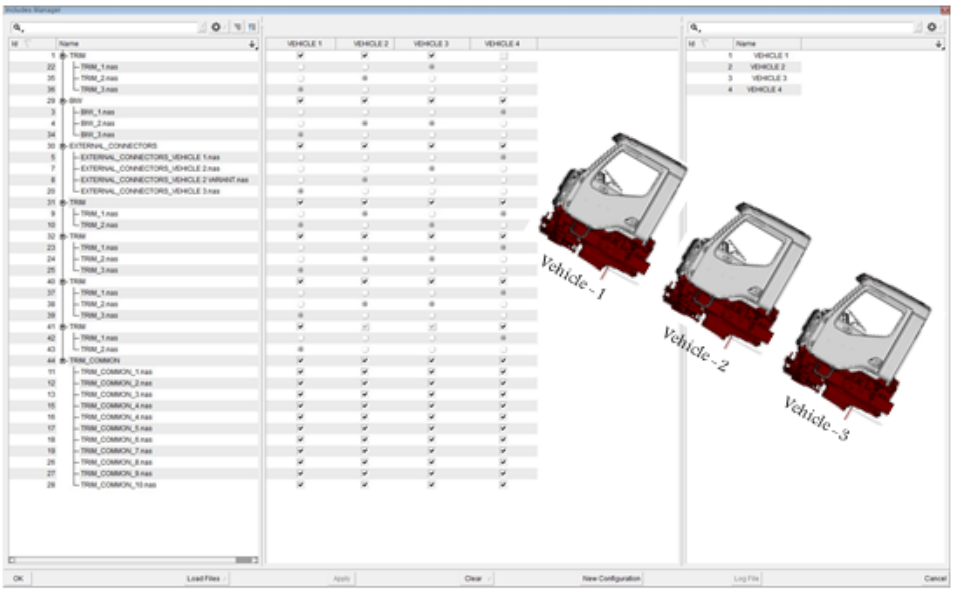


Figure 9: Include Matrix

6.2.2 Assembly with Connector Entities

Connector entities are used to model the kinematic constraints that physically exist between parts and sub-assemblies.
In this application, connectors are used to for the assembly of different includes.

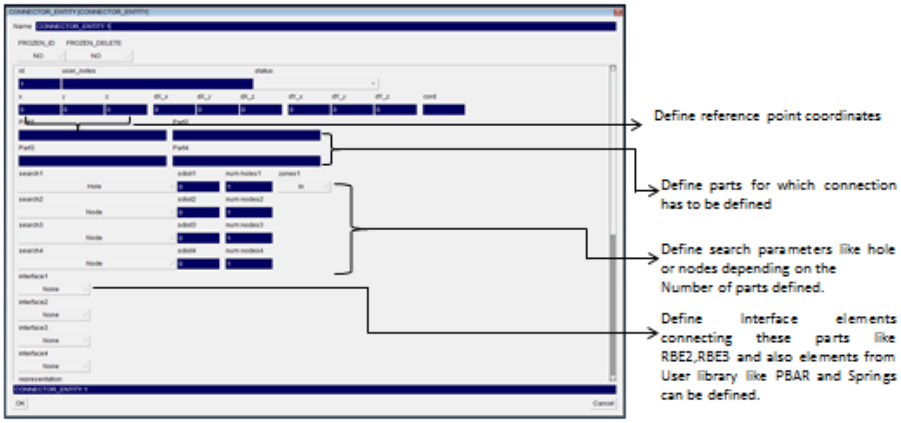


Figure 10: Connector Entities

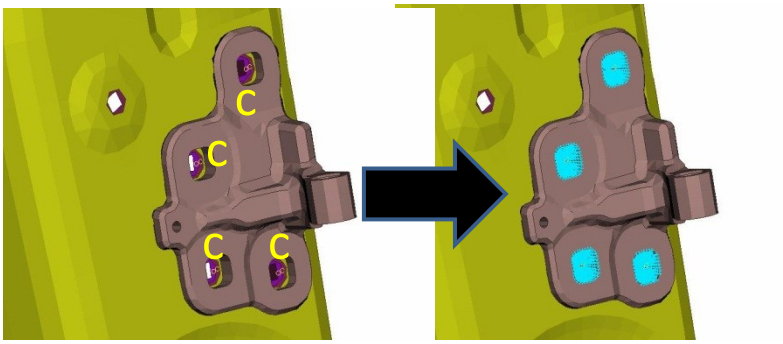


Figure 11: Connector Entity Representation

All the connectors of the model are placed in a single include file. This file contains both the FE-representation of the connectors and their definition, in the form of ANSA comments.

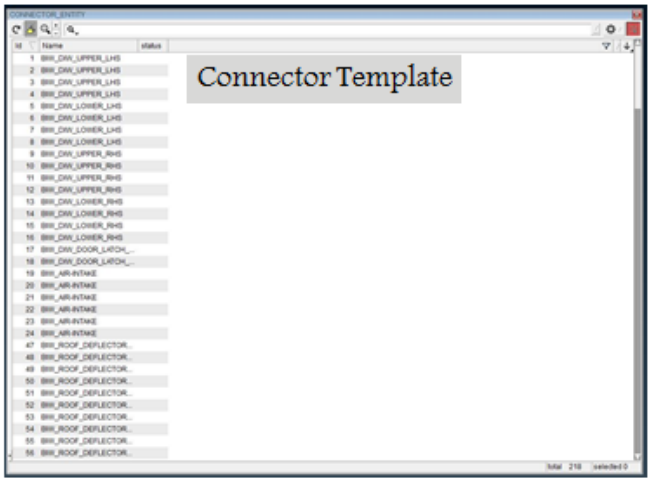


Figure 12: Connector Template

6.3 Use case 3: Data Exchange between different sites

In the previous topics, Ansa DM capabilities, features & benefits were discussed. However, there is also a need to have a systematic data exchange when there is Global interaction and programs. Therefore, to enhance the data exchange, a data repository system has been put in place. Below figure-13 illustrates the system function.

The data exchange system has the capability to synchronize the complete CAE data from one server to another which are available in the Ansa DM root in each of the servers. The sync checks for the new, updated or modified data, study versions, representations and performs the sync for those data.

The sync data is not directly moved to the main DM. It is copied to a local DM. The user can use the compare option in DM each time to check for updates. The user can then download and can save in their respective local DM. This assures that the Main DM in servers are neither over written nor duplicated. The system ensures that the original data remains in their respective sever. The files & data are updated as new files and are not over written.

The system is very effective and supports the development program across the globe to exchange data automatically. It is very systematic and time saver compared to conventional transfer protocols.

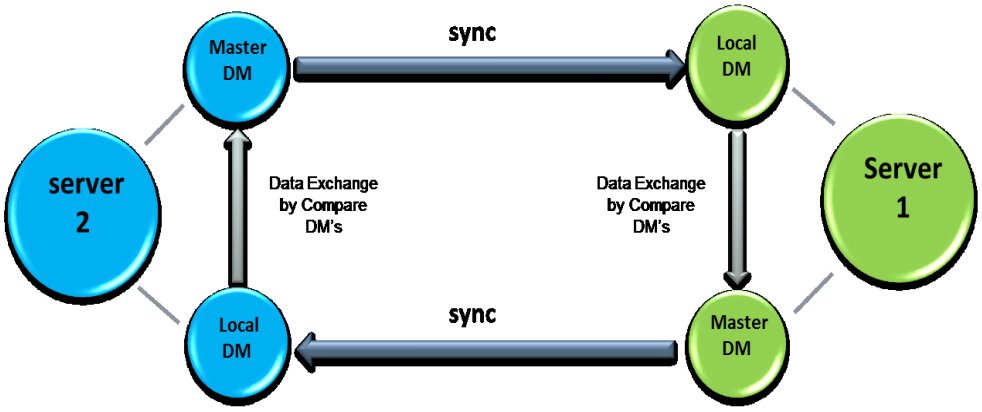


Figure 133: Data Exchange with DM

7 Conclusion

- CAE verifications are much quicker in pre-processing phase benefiting the design development for quick concept selection & design development
- Data from any program could be retrieved any moment. Complete CAE data of the project life cycle could be accessed across the users
- Ansa DM is an effective pre-processing tool
- The process is inexpensive
- DM assures no data loss of previous projects
- Ansa-DM process is simple to use

8 References

ANSA version 14.0.x User's Guide, BETA CAE Systems S.A.,