FLEXIBLE INFORMATION INTEGRATION
IN AUTOMOTIVE ENGINEERING

In the future, competitiveness in the automotive industry will depend to a large extent on how efficient and interdisciplinary a company functions, how it copes with the complexity of information and how it is linked. In the project FIND – Flexible Information Integration – VIRTUAL VEHICLE, together with partners Audi, Bosch, Porsche, Volkswagen, iCONDU and the Institute for Knowledge Technologies are studying the topic of information access from decentralised sources and the integration of information in a vehicle development environment.

Virtual vehicle development and complex topics require intensive collaboration by development engineers across disciplinary, departmental, site and company borders. This is made difficult today due to a range of different preferred methods and tools, and above all, due to a different perspective of the development tasks, processes and definitions.

The most effective access to information and knowledge possible is a prerequisite for interdisciplinary collaboration and is thus an increasingly important success factor.

Acquiring information in engineering today

The amount of input information, boundary conditions and interactions that people involved in development or production processes require to carry out their job has significantly increased over the past few years and will continue to do so (see figure 1).

There are currently many approaches for systems or processes to structure data at the milestone and synchronisation points in a process, which would facilitate access to information for people in development. However, in development phases between these milestones and particularly during early phases, the rate of change of the data and information is very high and simultaneously hardly supported. Comprehensive and poorly structured data conglomerations on storage drives are still the order of the day.

Large monolithic approaches to information management in the past were largely without success. For reasons of self-management and efficiency, due to a lack of suitable technological alternatives, or simply for historical reasons, local solutions were very often created in the individual disciplines that generally supported the users well and enjoyed a much higher acceptance factor that centralised systems.

The great challenge today is the integration of all this information for an interdisciplinary product development and in the spirit of a consistent total product.

This is true for the example of system simulation, when it comes to collecting the necessary and suitable calculation models from the various departments for fuel consumption simulation: the competence to solve complex development projects today requires a high degree of individual communication and agreement via email, telephone and meetings. It is difficult to obtain an overview of all relevant information concerning a topic and it requires a high level of personal engagement. The integration and linking of information occurs in the minds of the developers and the probability of success depends almost entirely on their personal networks.

Objectives of the research project „Flexible Integration of Information and Decentralised Sources"

The objective of the project "FIND – Flexible Information Integration for the Virtual Vehicle Development", started by VIRTUAL VEHICLE in 2012 was to provide support to developers for particularly complex development tasks spanning multiple departments and people. The task was to establish an efficient, central access to information and its links, without
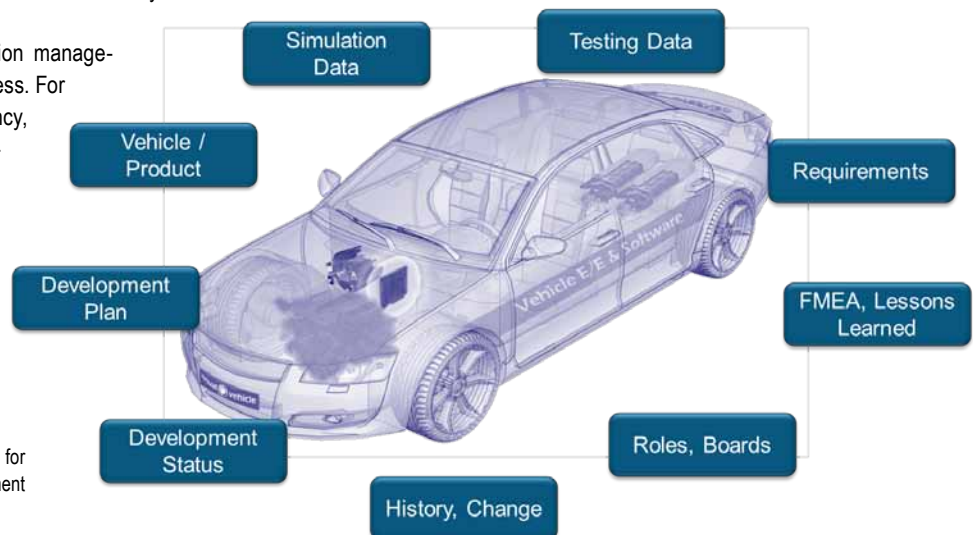

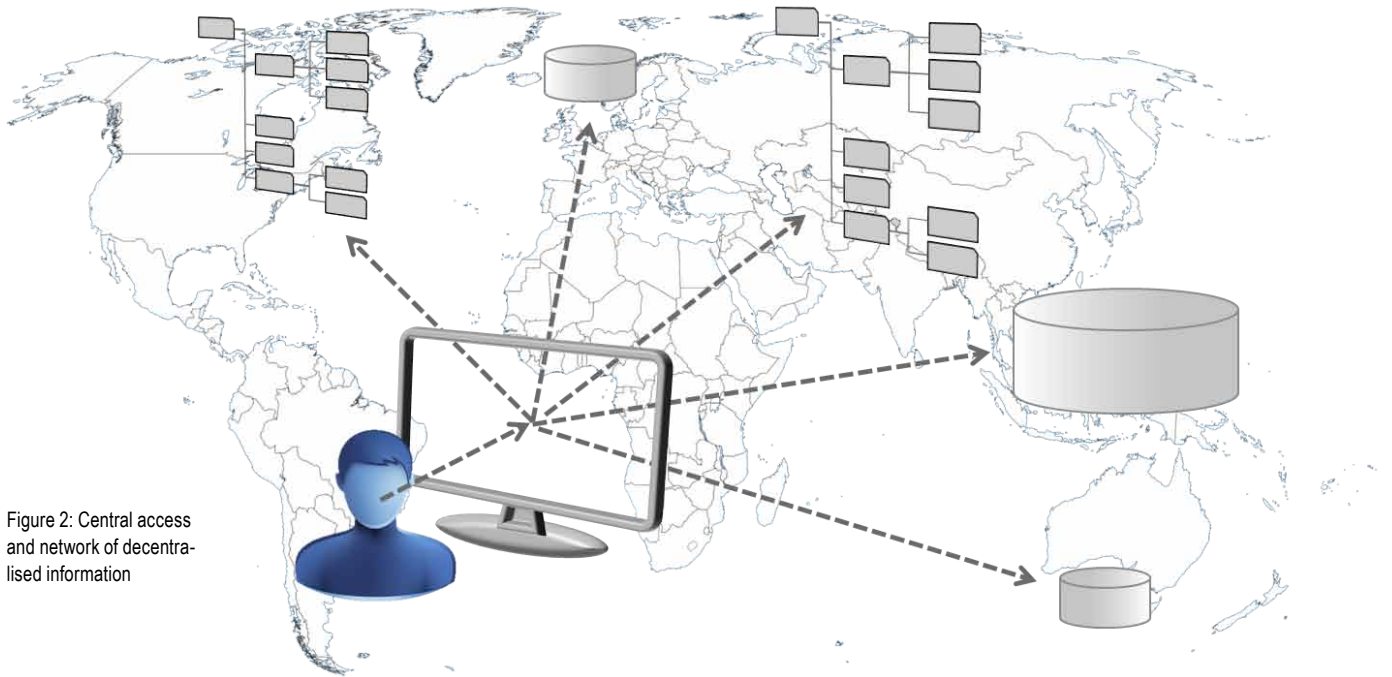Figure 1: Relevant areas of information for functional development

Figure 2: Central access and network of decentralised information

centralising the data sources. This way, access should be possible in numerous, decentralised, structured and semi-structured sources of information for functional development in the areas of virtual development that require high number of calculations (see figure 2).

Information demand and boundary conditions

Many discussions with users involved in development were conducted and their evaluation gave insights into which type and in which context the access to information and its interconnections is useful and required. Two basic types of access crystallized out of the discussions, independently of the project partners:

- The search for or free exploration of documents and information within the relevant timeframe (for example the search for a suitable calculation model of a component for simulation purposes).
- A compiled view of different information from a variety of sources into a particular perspective (for example to a particular topic or a defined development stage).

The analysis of the data and data sources showed that the need for information and knowledge in development stages actually occurs between milestones. It is here, particularly in the CAE environment, that the pace is high and most of the relevant information is stored on only partially structured file-shares. This is also linked to many specific requirements for access to information and its network.

The spectrum of information required for the CAE-driven development extends far beyond pure simulation data. Since vehicles and components today display a high degree of complexity, the persons involved in development need to take all interconnections into account in time:

- What effect does the platform block structure have?
- What is the neighbouring discipline currently working on?
- When is the deadline for the component supplier development?

Combination of technological building blocks as a modular solution approach

The requirements survey and the lessons learned from the evaluation of the data and the data sources, together with the strategic aspects of

partners resulted in a complete picture of the current and future initial situation.

The use of flexible and intelligent technologies to gain access to information and the integration of relevant information for the developer is a promising approach to improving the way information is accessed. This includes the following solutions:

- Enterprise search
- Analytical networking processes
- Knowledge-based networking processes

An analysis of the technologies shows that each of the investigated approaches fulfils its potential for a part of the requirements. However, it is only the combination of the approaches that can cover all the user needs and requirements out of the data.

The modular approach in the project made it possible to combine the different approaches using an intelligent transformation layer in order gain substantial added value when accessing the data and their relationships (see figure 3).

Prototype build

The research project FIND developed and built a prototype of an information cockpit for users in virtual function development. To achieve the optimal support of users, topically interconnected information and documents (project presentations, simulation models, requirement lists, project plans, lessons learned, etc.) from unstructured and structured sources were connected and related to one another.

A major challenge in attempting to guarantee a role and process independent fulfilment of search and query results is posed by the IT security guidelines due to the role and rights structure prevalent in vehicle development. To solve this, a concept of context-based rights management was developed.

The user interface presents itself to the search users as a web-conform information and knowledge cockpit. This guarantees focussed access to the event and decision relevant information, interactions and knowledge carriers that are the minimum required to solve the corresponding task in the development process.
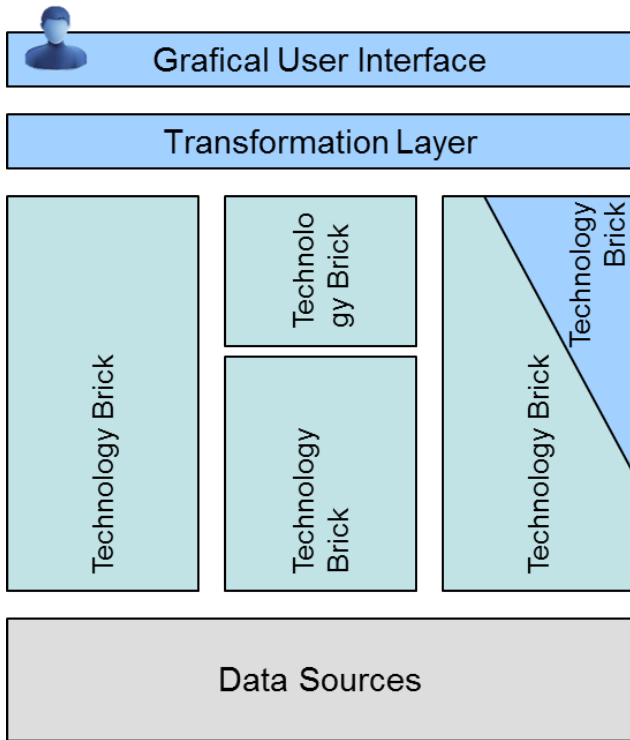
Figure 3: The modular technological concept combines technology approaches via a transformation layer.

Not only is information from data sources visualised task specifically, but also the relevant knowledge carrier. Thus the industrial partners can optimally connect to and use decentralised and available knowledge in vehicle development. The prototype developed here contains functions that intelligently combine various technological approaches in order to access areas that prove difficult to connect to and to present and prepare the information in a form the user can understand.

Procedure used in the project

From the very beginning, emphasis was placed on orienting the project on the actual and strategic informational needs of the user. Many discussions were conducted and permitted a concrete picture and requirements profile to be generated. A first demonstrator offered the possibility to give feedback and to confirm the relevance. A functional architecture model connected requirements, use-cases and elementary functions of the overall concept into a consistent relationship.

A technological analysis permitted approaches to be selected that are integrated in the current technological concept.

The realisation of a prototype of the concept in a special system laboratory is intended to provide the verification of the approach using concrete example data and sources from the industrial partners.

Associated fields of activity

Apart from the development on a technological concept and prototype, non-technical boundary conditions are especially investigated that must be present, if the approach is to be successful. The following must be present in an open company culture:
- The paradigm shift from "need-to-know" to "good-to-know" principle.
- The constructive discussion of the conflicting targets between IT data security and available access to information.

- The recognition of active provision of information and networking as a competitive factor and, especially for simulation, the change from the calculation to the supplier and service provider for models and data.

Outlook

The rapid availability of relevant data and information is an important success factor in vehicle development. Flexible solutions for the search and networking of information are required in order to tap into the legacy of decentralised solutions.

The technology concept described here and the associated fields of activity should not represent a search solution for general fields of application, but to facilitate in particular the optimal access to information in the field of vehicle development and, taking these user characteristics into account, to manage the information requirements and the existing system landscape.

Researchers at VIRTUAL VEHICLE, with their different perspectives, are actively searching for innovative approaches to enable this informational networking. There is both sufficient experience out of the industrial and user perspective, as well as methodological, analytical and technological competence available. It is exactly this combination that is currently generating lively interest in the industry. ■

THE AUTHORS

DR. BERND FACHBACH is Scientific Manager of the Information & Process Management department and Cross Domain Research at VIRTUAL VEHICLE.

MARKUS ZOIER is Senior Researcher in the Information & Process Management department at VIRTUAL VEHICLE.