VMAP

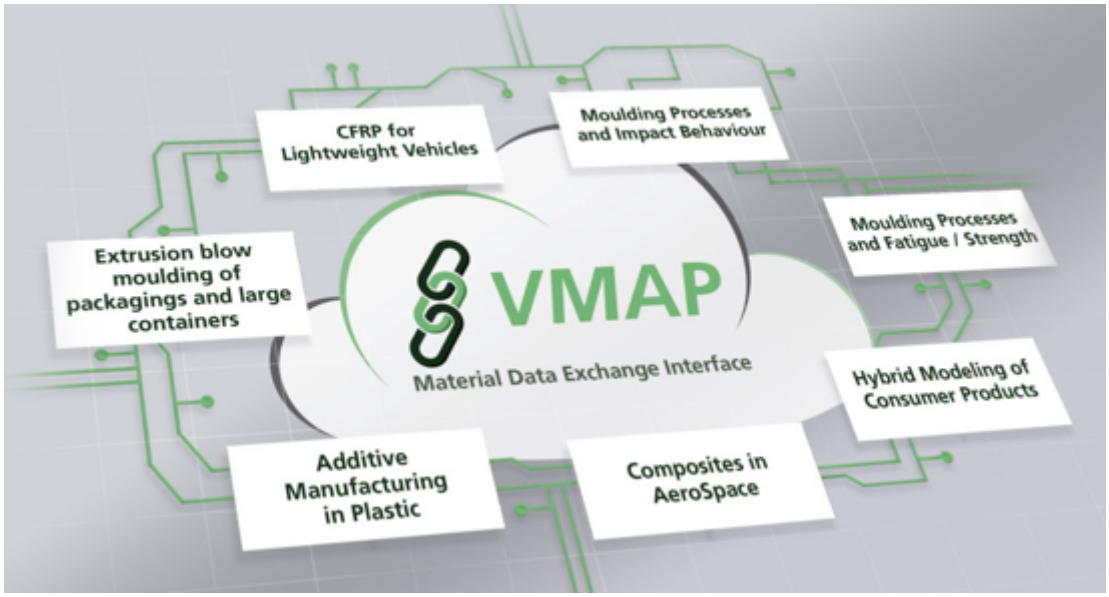
A new Interface Standard for Integrated Virtual Material Modelling in the Manufacturing Industry

Addressing the Challenge - Interoperability in CAE Workflows

A lack of software standards in virtual engineering workflows as well as incompatible interfaces for the transfer of virtual material information not only cause additional costs and complex manual adaptation but also lead to inflexible IT solutions, loss of information, and significant delays in the overall design process. The standardisation of material interfaces in computer-aided engineering (CAE) is therefore vital for all industry segments where material behaviour is central to product and process design.

The goal of the ITEA project VMAP was to create the first open vendor-neutral standard for computer-aided engineering data storage, thereby enhancing the interoperability of software tools and reducing costs and effort for companies. An open standardisation community will help push this into domains beyond the scope of the project, guaranteeing these benefits in both the short and long term. The project was very pleased to win the ITEA Award of Excellence 2021 in Standardisation (https://itea4.org/news/congratulations-to-our-2021-itea-award-of-excellence-winners.html), one of the reasons being that using VMAP should increase innovation speed by 50% and reduce setup time for virtual process chains by 40%.

A wide range of CAE software tools already enable virtual material and product design, virtual manufacturing and machining process parameterisation, and virtual product testing of high-tech materials. However, these tools are rarely interoperable and contain multiple native formats for storing the CAE data to be transferred between simulation codes, such as geometrical information, simulation results, and metadata. The corresponding lack of standardisation means that companies have to implement customised data transfer solutions – a huge effort in terms of both time and money.



Industrial Use Cases from the ITEA VMAP project will show the need and benefits of a standardised Material Exchange Interface.

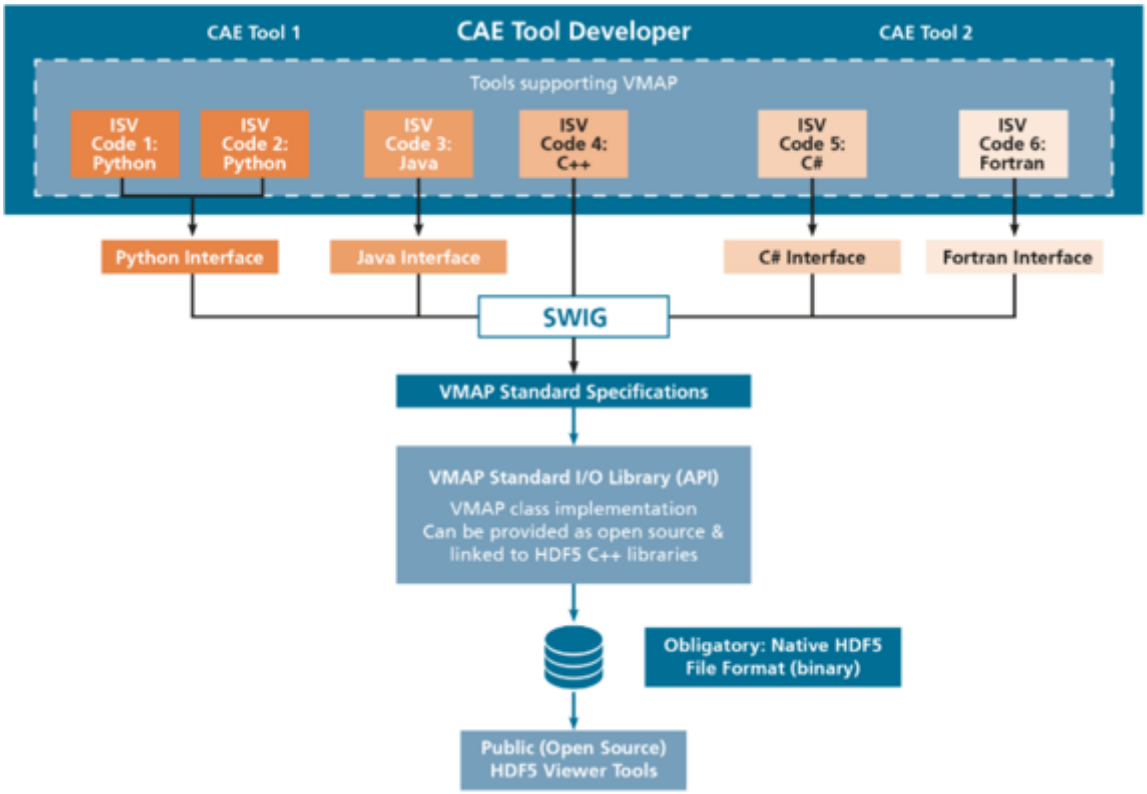
The VMAP Standard

The VMAP project has filled this gap by creating the world's first CAE workflow interface standard. This is vendor-neutral, cost-free, and completely open to any interested party, which should help maximize its uptake amongst companies of all sizes. Input/output (I/O) routines have also been provided for easy implementation. With the uptake of this standard, VMAP's end-users will enjoy a faster time to market and lower production costs through a decrease in the amount of manual work and corresponding human error in their CAE workflows.

VMAP is a vendor-neutral standard for CAE data storage to enhance interoperability in virtual engineering workflows.

Features:

- Meta and user data
- Geometry and discretization
- Coordinate and unit systems
- Result and state variables
- Parameters for (material) models
- Based on HDF5 (High-performance data management and storage suite)
- Software library available to read/write VMAP data files
- Tutorials and test cases
- Strong community including industry, software companies and vendors, experts from academia, etc.



The VMAP Standards Community

VMAP Standards Community

(https://vmap.vorschau.ws.fraunhofer.de/)

The VMAP Standards Community e.V. (https://vmap.vorschau.ws.fraunhofer.de/en/vmap-sc.html) (VMAP SC) will be established as a legally registered not-for-profit association during 2022 by 15 founding members. Membership will be open to any interested party that wants to use or contribute to the standardization efforts. Specification documents and directly related software components of the VMAP Standard shall be made available to any interested party - VMAP SC members as well as external institutions - on a royalty-free basis.

The purpose of the Association is the dissemination of the VMAP Standard and its further development, and the assurance and maintenance of a uniform library standard. This comprises the coordinated standardization and development of software technology and methods in the area of engineering and other data transfer within CAE, simulation processes, and related areas such as virtual product development, artificial intelligence (AI), and machine learning (ML).

In particular, VMAP SC e.V. develops and promotes the VMAP Standard and VMAP IO Software Libraries for specification, modelling, simulation and other analysis, design, and learning methods, as well as systems operations of physical and technical systems and processes. The VMAP IO Libraries will be licensed to interested parties on a royalty free basis.

Project Website:https://vmap.vorschau.ws.fraunhofer.de/ (https://vmap.vorschau.ws.fraunhofer.de/)

Contact: Dr. Gino Duffett | gino.duffett@nafems.org (mailto:gino.duffett@nafems.org)

Download VMAP Project Leaflet (/downloads/dropbox/nologin/vmap_project_leaflet_2020.p

Original Project Partners

The VMAP project was coordinated by Fraunhofer SCAI and endorsed by the project partners Audi, Bosch, EDAG, Rikutec and Philips.

The 29 project partners (https://itea4.org/project/vmap.html) were:

Austria:	4a engineering GmbH, Wittman Battenfield GmbH
Belgium:	MSC Software Belgium S.A.
Canada:	Convergent Manufacturing Technologies Inc.
Germany:	Audi AG, Dr. Reinold Hagen Stiftung, DYNAmore GmbH, EDAG Engineering GmbH, ESI Software Germany GmbH, Fraunhofer SCAI, Hagen Engineering GmbH, inuTech GmbH, Karlsruhe Institute of Technology (KIT),Kautex Maschinenbau GmbH, NAFEMS Deutschland, Österreich, Schweiz GmbH, RIKUTEC Richter Kunststofftechnik GmbH & Co. KG, Robert Bosch GmbH, Simcon kunststofftechnische Software GmbH
Netherlands:	Delft University of Technology,DevControl B.V., In Summa Innovation bv, KE-works, Materials innovation institute M2i, MSC Software Benelux, Philips,Reden BV, University of Groningen
Switzerland:	BETA CAE Systems International AG Sintratec

Project Funding

The project “VMAP: A new Interface Standard for Integrated Virtual Material Modelling in Manufacturing Industry” was organised via the ITEA programme (https://itea3.org/project/vmap.html (https://itea3.org/project/vmap.html)). The project period was from October 2017 to September 2020.

- The Austrian part of the joint project is funded by the Austrian Research Promotion Agency (FFG - Project 864080)
- The Belgian part of the joint project is funded by participating companies
- The Canadian part of the joint project is funded by the Scientific Research and Development Tax Credit Program
  (RS&ED)
- The German part of the joint project is funded by the German Federal Ministry of Education and Research
  (BMBF - Project 01|S17025 A - K)
- The Netherlands part of the joint project is funded by the Netherlands Enterprise Agency
- The Swiss part of the joint project if funded by participating companies

ITEA (https://itea3.org/) is the EUREKA Cluster programme supporting innovative, industry-driven, pre-competitive R&D projects in the area of Software-intensive Systems & Services (SiSS). ITEA stimulates projects in an open community of large industry, SMEs, universities, research institutes and user organisations. ITEA is a EUREKA Cluster, the community is Europe founded based on the EUREKA principles and is open to participants worldwide.

Past Projects (/about-us/projects/past-projects/)

- VMAP (/about-us/projects/past-projects/vmap/)
- SimBest (/about-us/projects/past-projects/simbest/)
- COGAN (/about-us/projects/past-projects/cogan/)
- SMiRT-23 (/about-us/projects/past-projects/smirt23/)
- FEM Forging (/about-us/projects/past-projects/femforging/)
- EASIT2 (/about-us/projects/past-projects/easit2/)
- CCOPPS (/about-us/projects/past-projects/ccopps/)
- Engineering Skills Management Consultation (/about-us/projects/past-projects/esm/)
- Autosim (/about-us/projects/past-projects/autosim/)
- FE-Net (/about-us/projects/past-projects/fenet/)
- ILTOF (/about-us/projects/past-projects/iltof/)
- NUFRIC (/about-us/projects/past-projects/nufric/)
- SAFESA (/about-us/projects/past-projects/safesa/)
- GEM (/about-us/projects/past-projects/gem/)