

ITEA VMAP

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

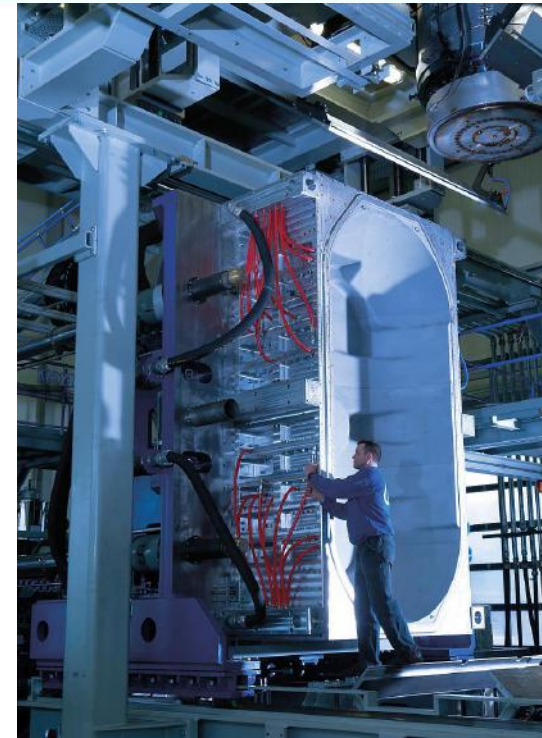
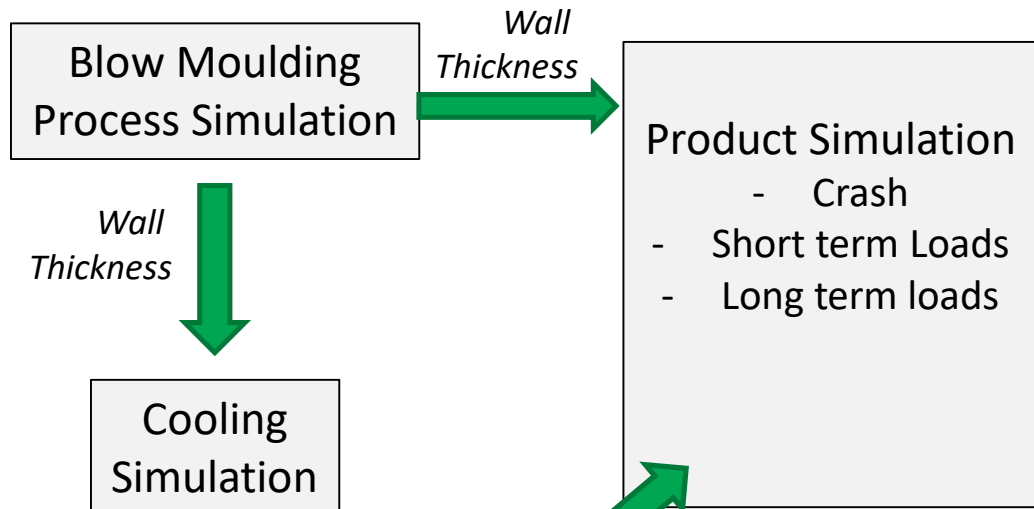
EMMC 2019

25-27 February 2019

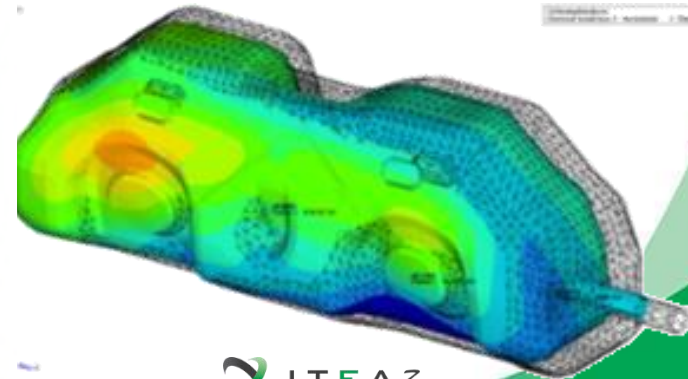


Virtual Design and Engineering

Example - Blow-Formed Containers



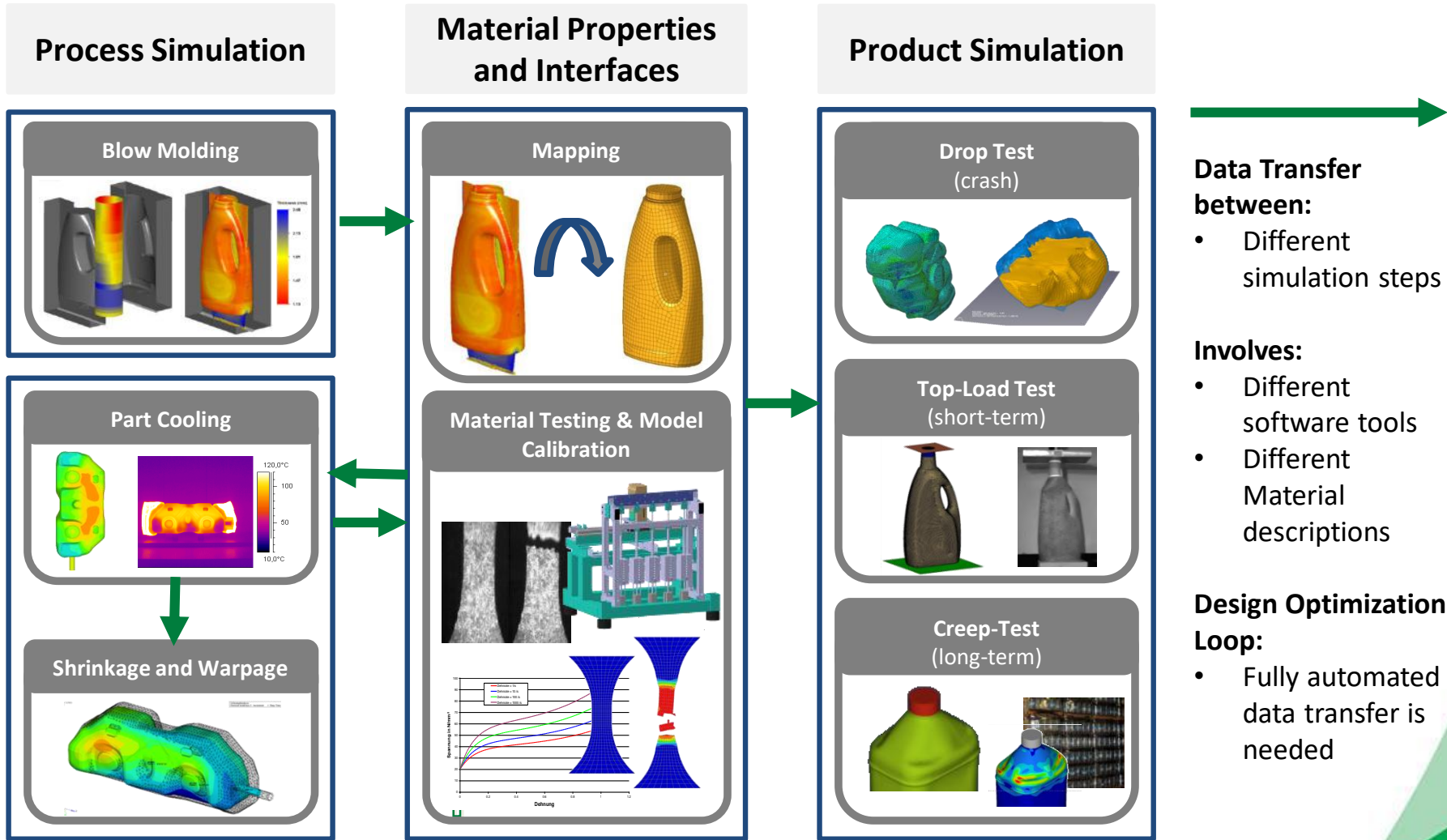
2018



February 7, 20

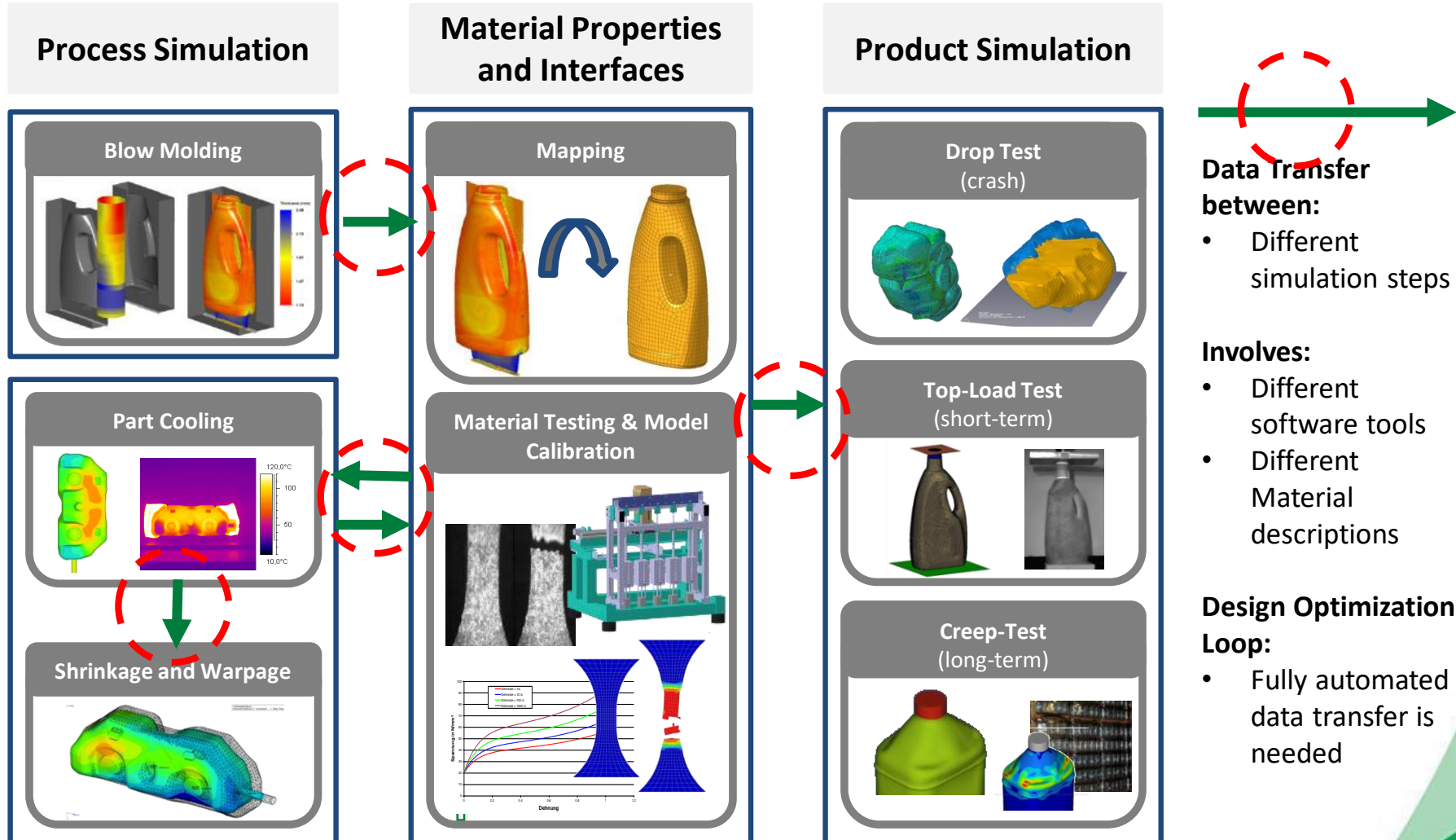
Virtual Design and Engineering

Example - Blow-Formed Containers



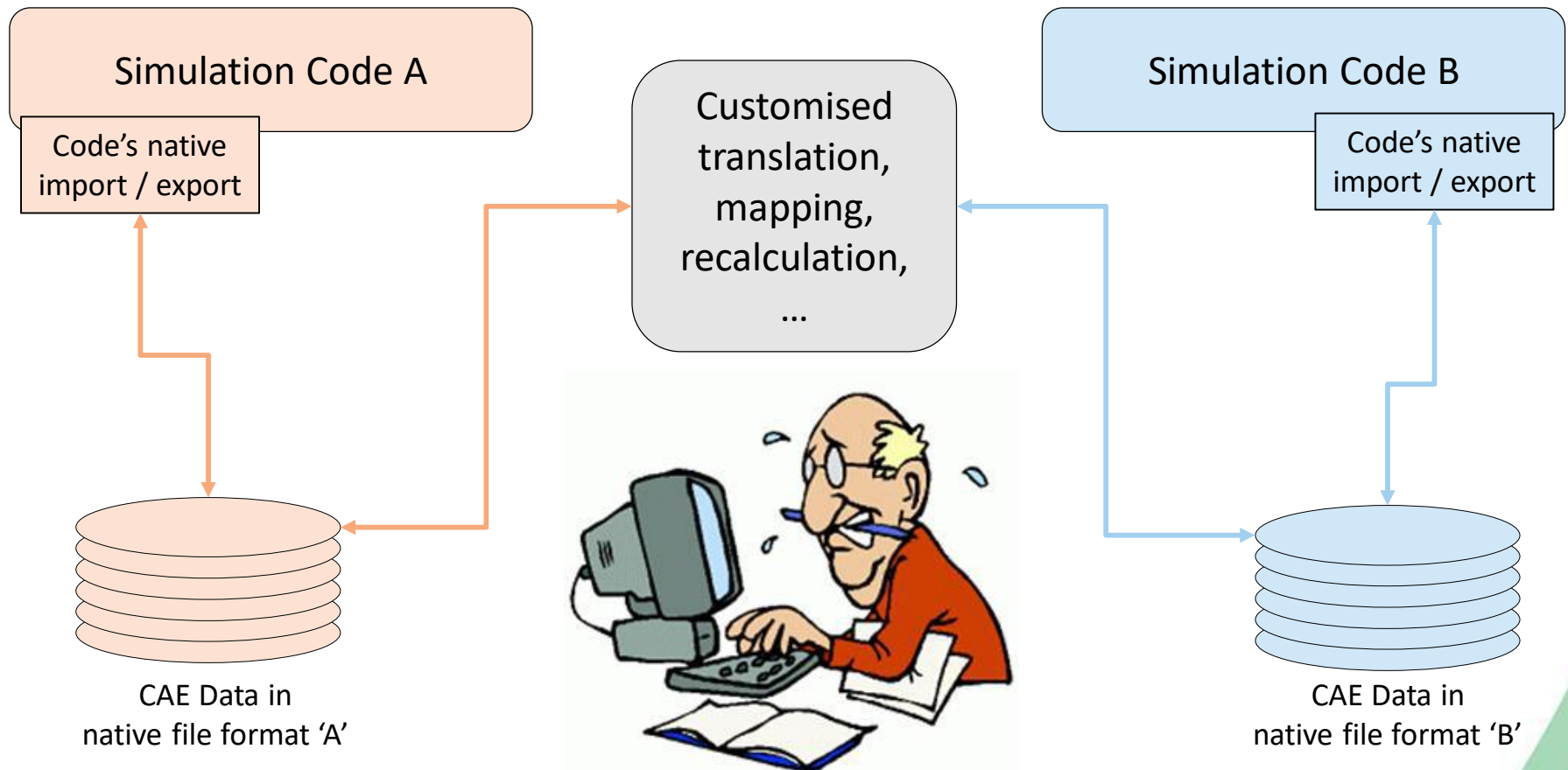
Virtual Design and Engineering

Example - Blow-Formed Containers

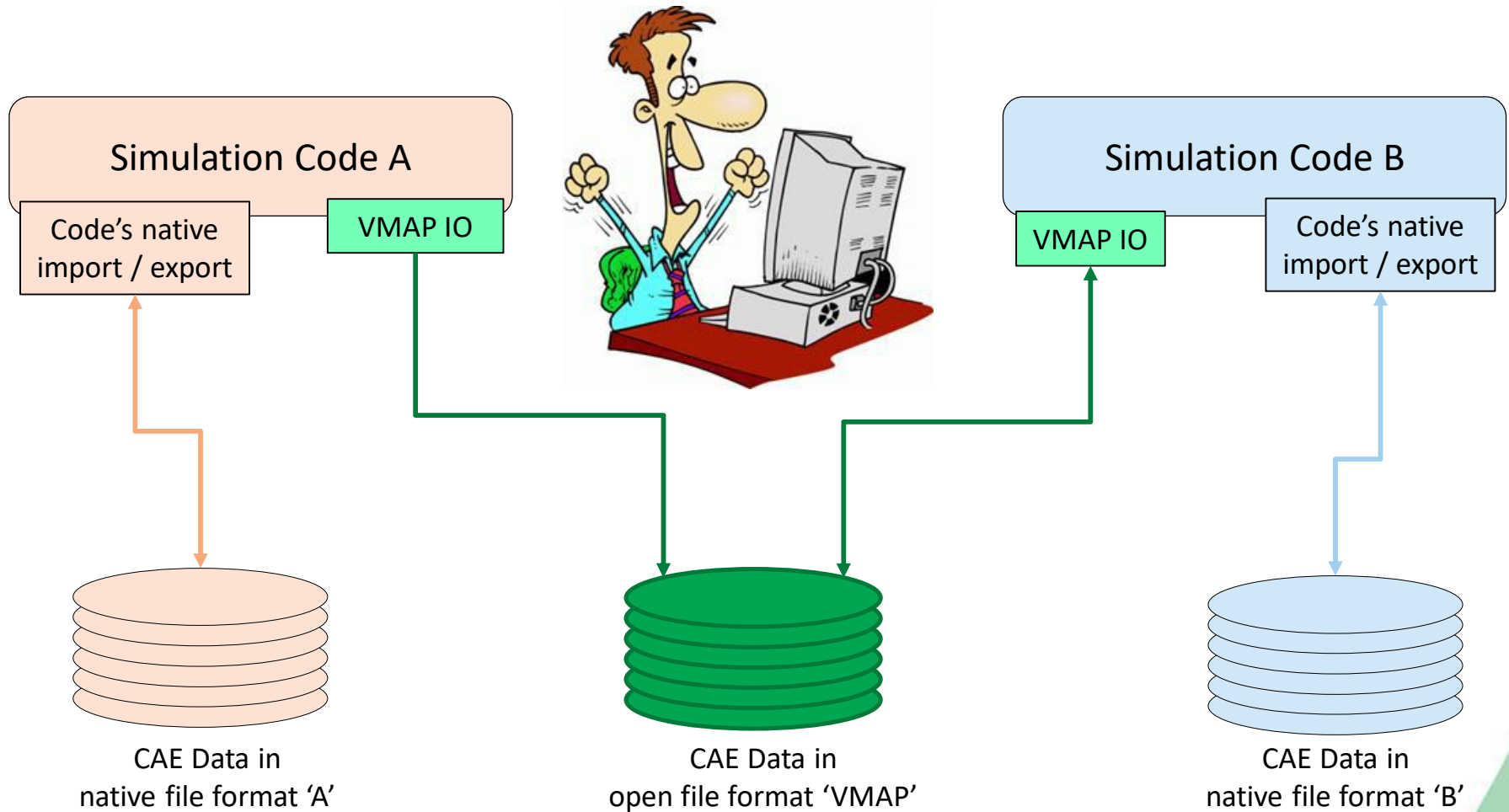


Interface standard is missing

Current Situation



Ideal Solution



VMAP Goal: A new interface standard for material data transfer in CAE workflows



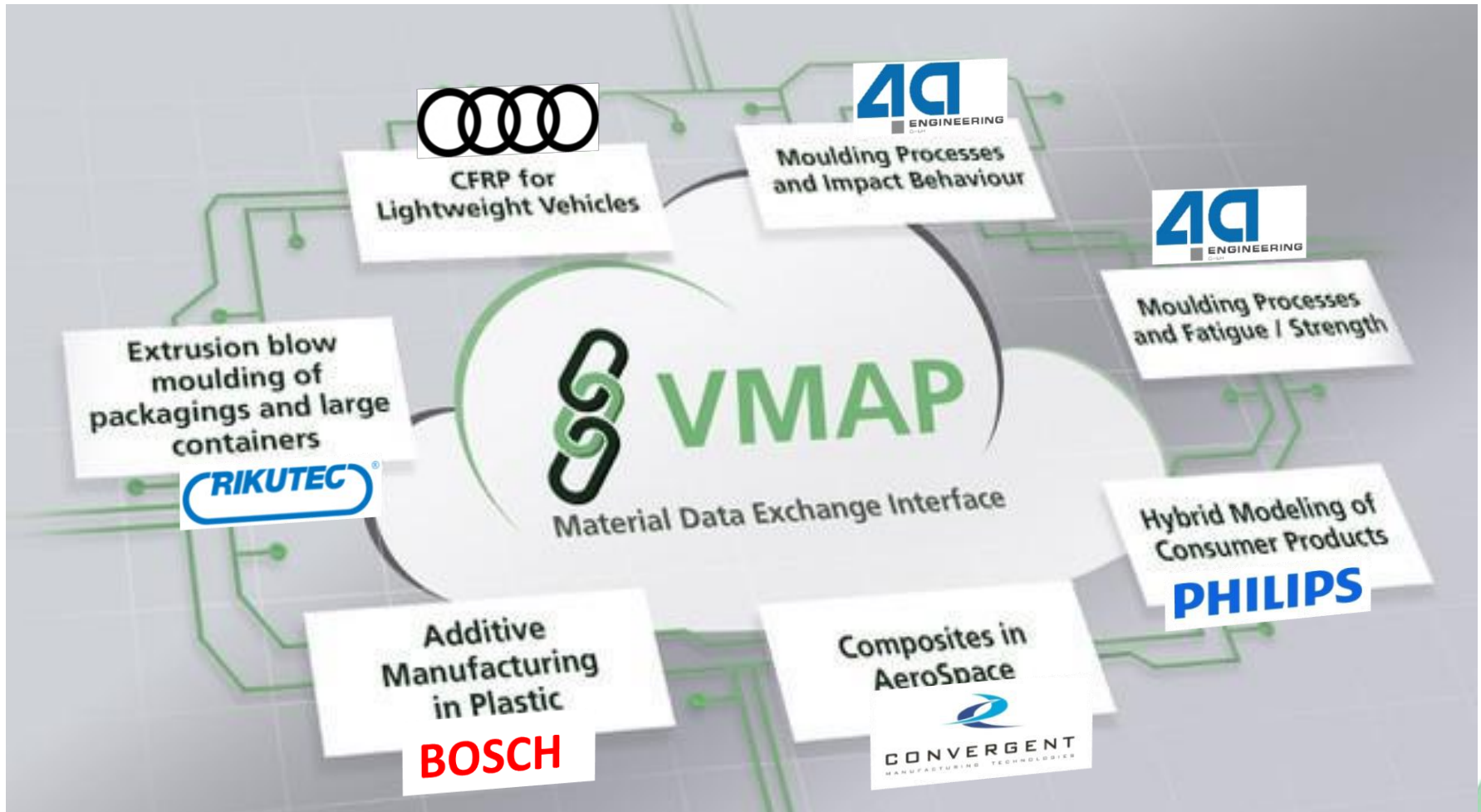
The major goal of the project VMAP therefore is to gain a common understanding and interoperable definitions for virtual material models in CAE. The VMAP project will run industrial use cases from major material domains and with representative manufacturing processes.

- VMAP will generate universal concepts and **open software interface specifications** for the exchange of material information in CAE workflows.
- VMAP will realise **prototype implementations** for extended CAE tool interfaces and – where necessary – translation tools which follow the open interface specification.
- VMAP will implement virtual **industrial demonstrators** for relevant material domains and manufacturing processes and provide best-practice guidelines for the community.
- VMAP will establish an open and vendor-neutral **‘Material Data Exchange Interface Standard’ community** which will carry on the standardisation efforts into the future.

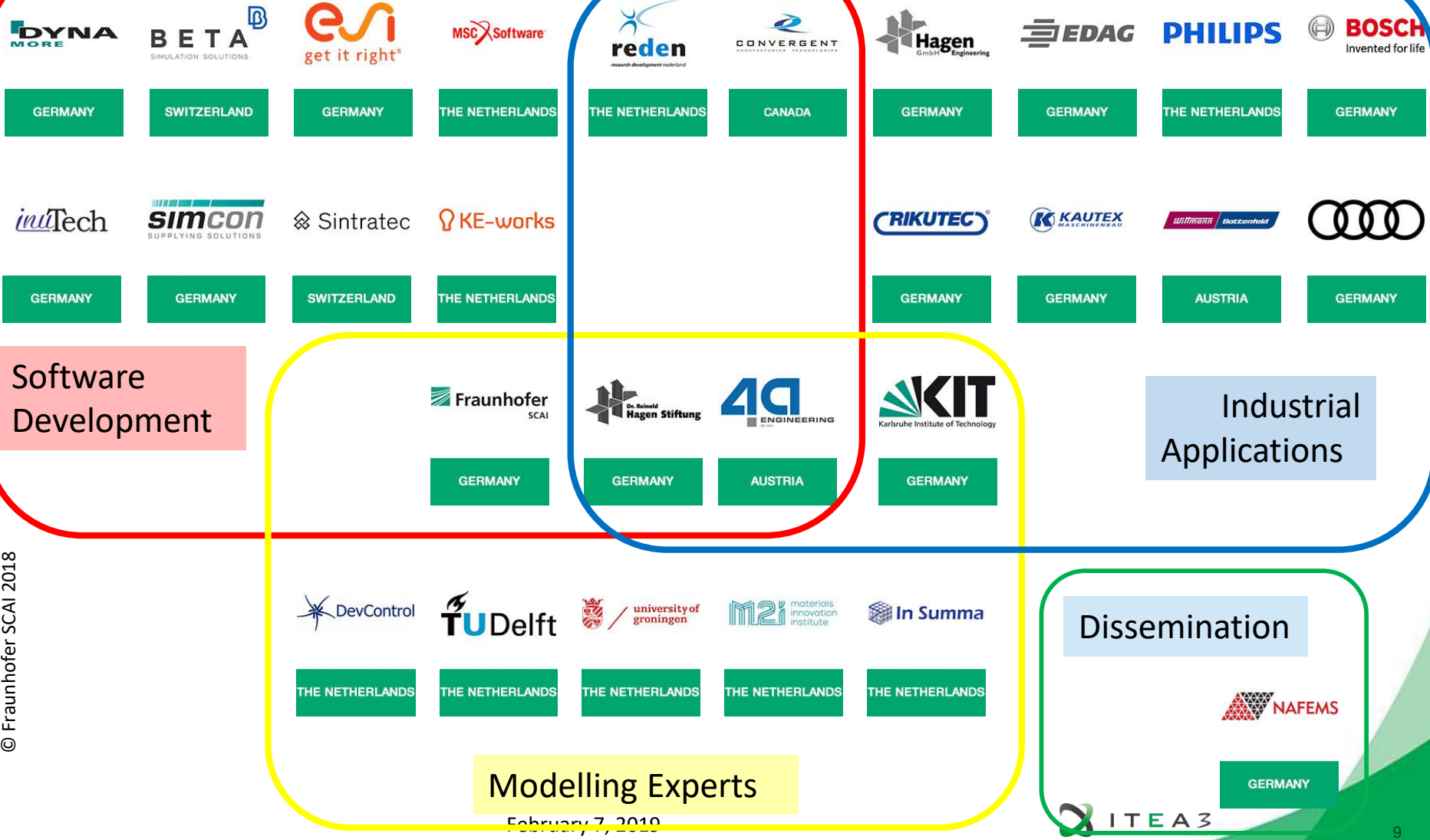


https://www.nafems.org/about/vendor_network/

Material Data Interface VMAP Demonstrators



Material Data Interface VMAP Consortium

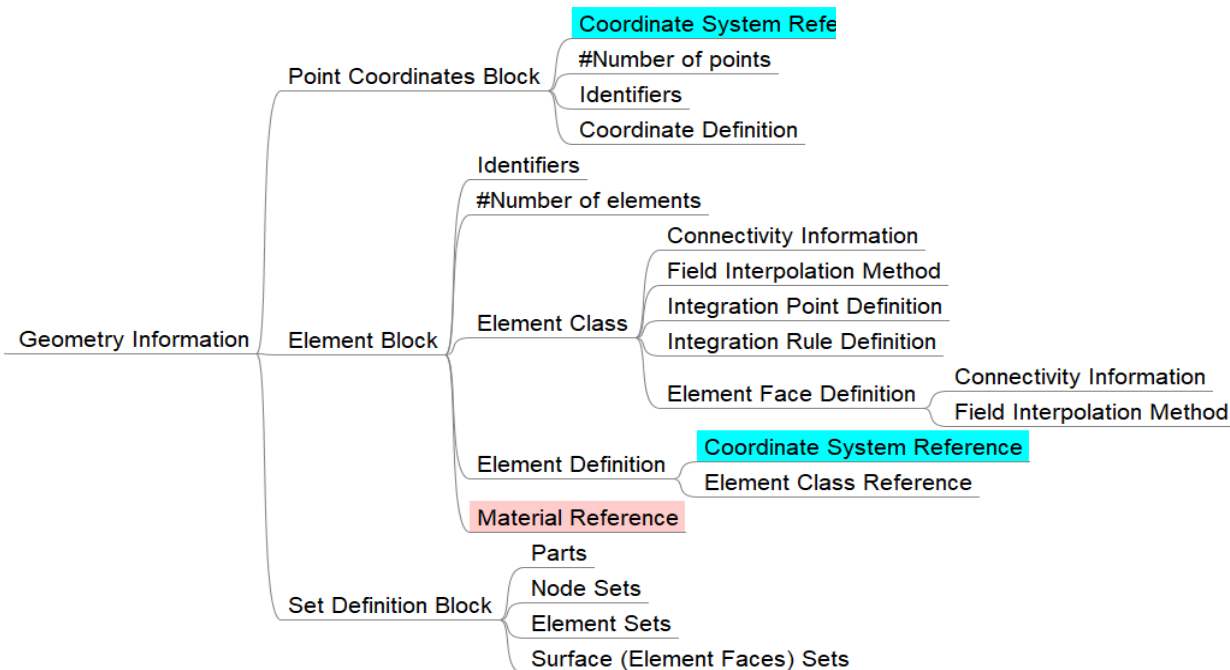
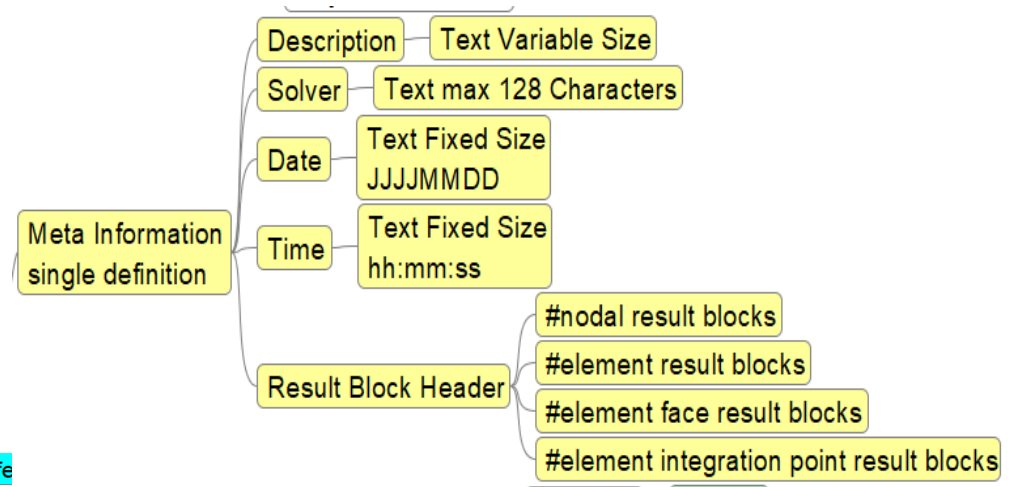


Material Data Interface

VMAP Interface Concept



- Meta Information
- Geometry Information

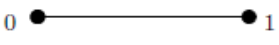
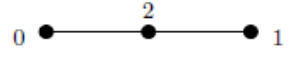


Material Data Interface

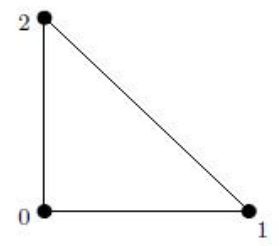
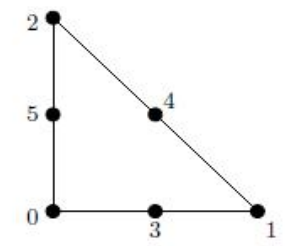
VMAP Interface Concept



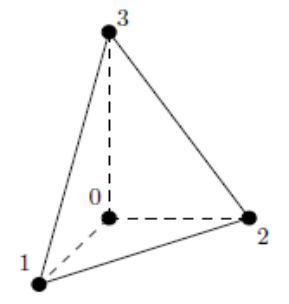
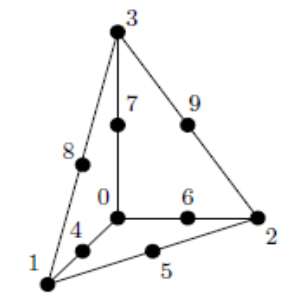
line elements

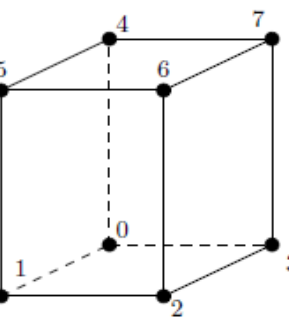
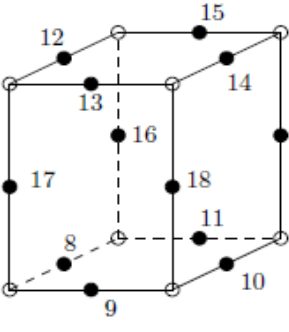
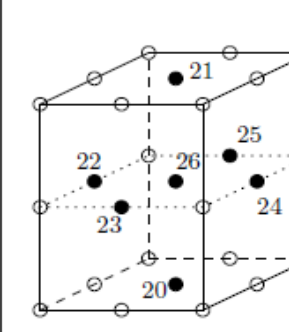
2 nodes	3 nodes
*_LINE2	*_LINE3
	

triangular elements

3 nodes	6 nodes
*_TRIA3	*_TRIA6
	

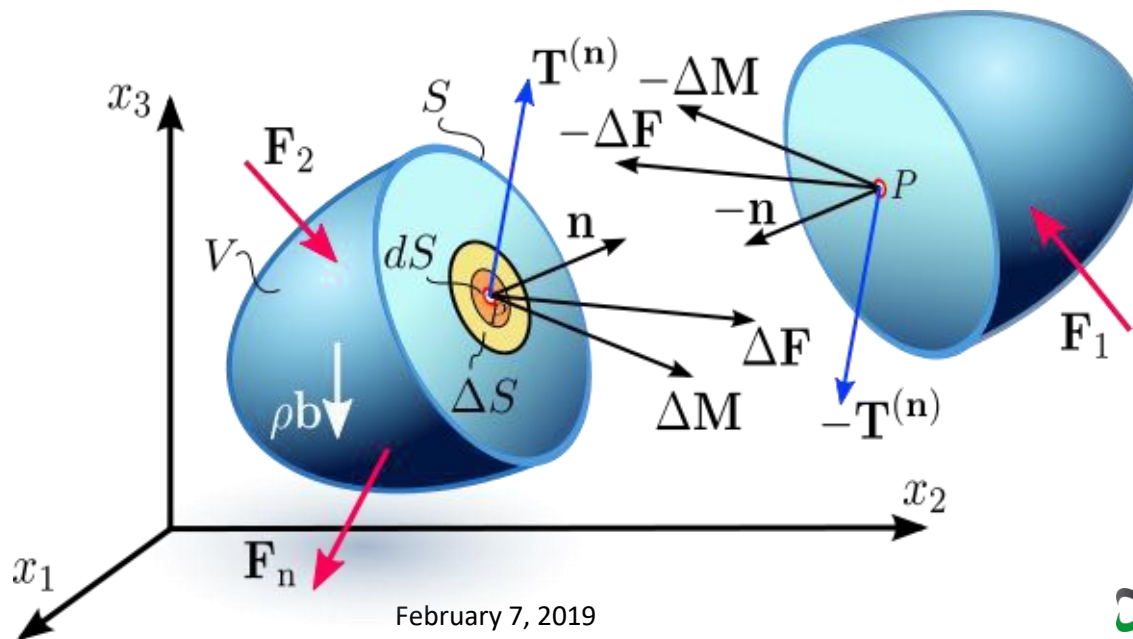
tetrahedral elements

4 nodes	10 nodes
*_TET4	*_TET10
	

8 nodes	20 nodes	27 nodes
*_HEX8	*_HEX20	*_HEX27
		

Stress tensor may refer to:

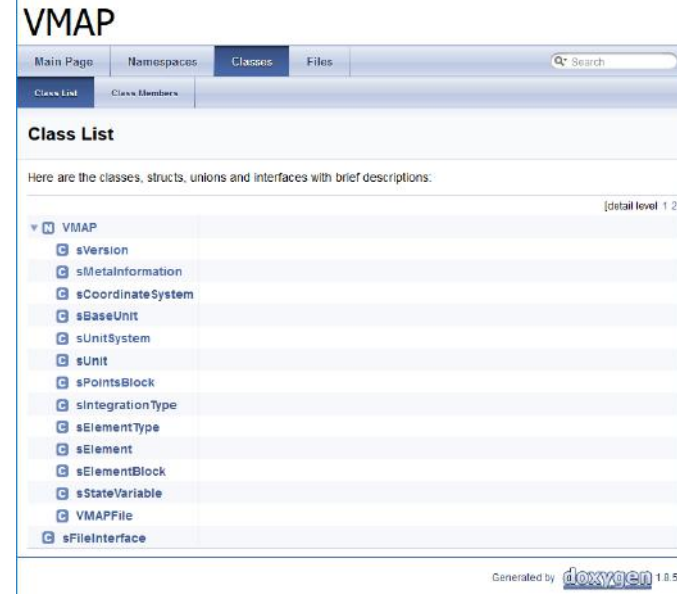
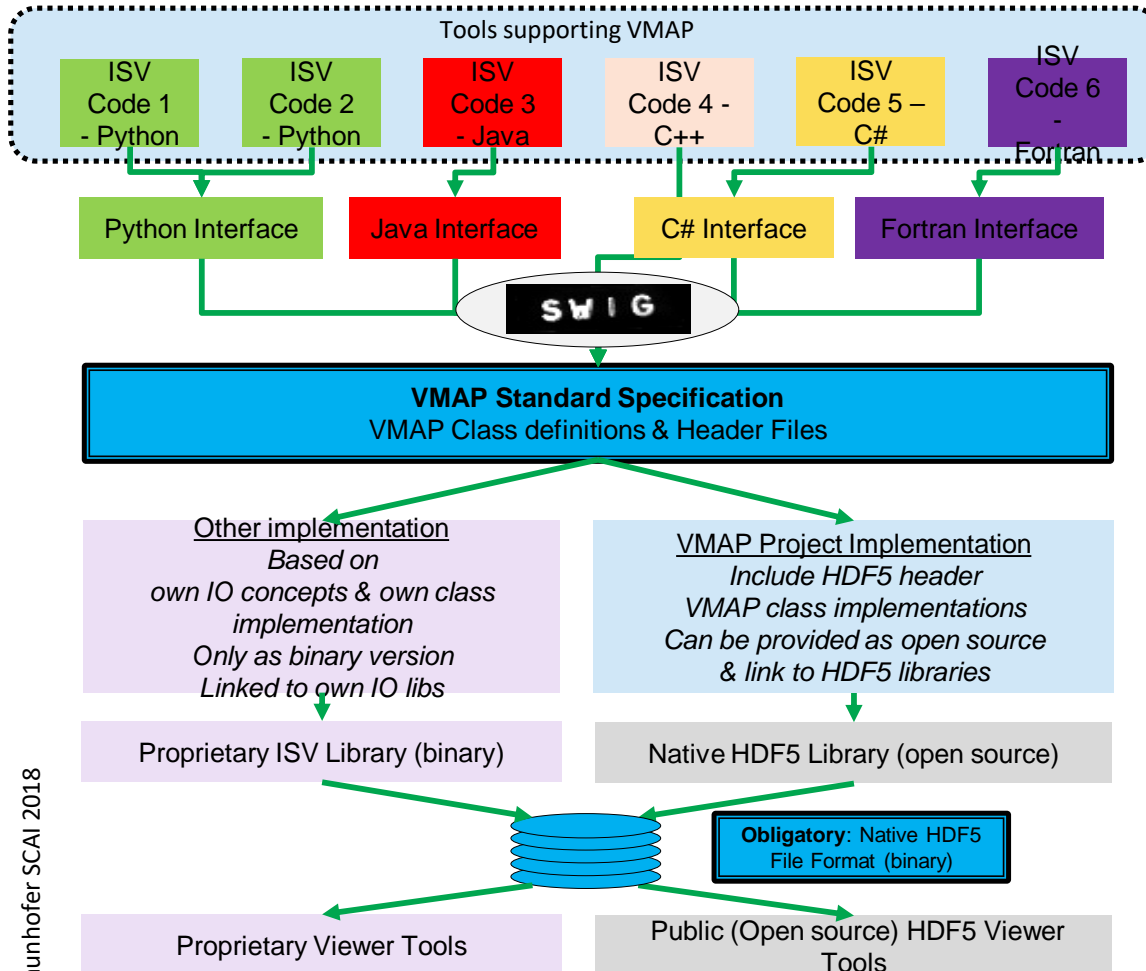
- [Cauchy stress tensor](#), in classical physics
- [Stress deviator tensor](#), in classical physics
- [Piola–Kirchhoff stress tensor](#), in continuum mechanics
- [Viscous stress tensor](#), in continuum mechanics
- [Stress–energy tensor](#), in relativistic theories
- [Maxwell stress tensor](#), in electromagnetism



WIKIPEDIA
The Free Encyclopedia

Material Data Interface

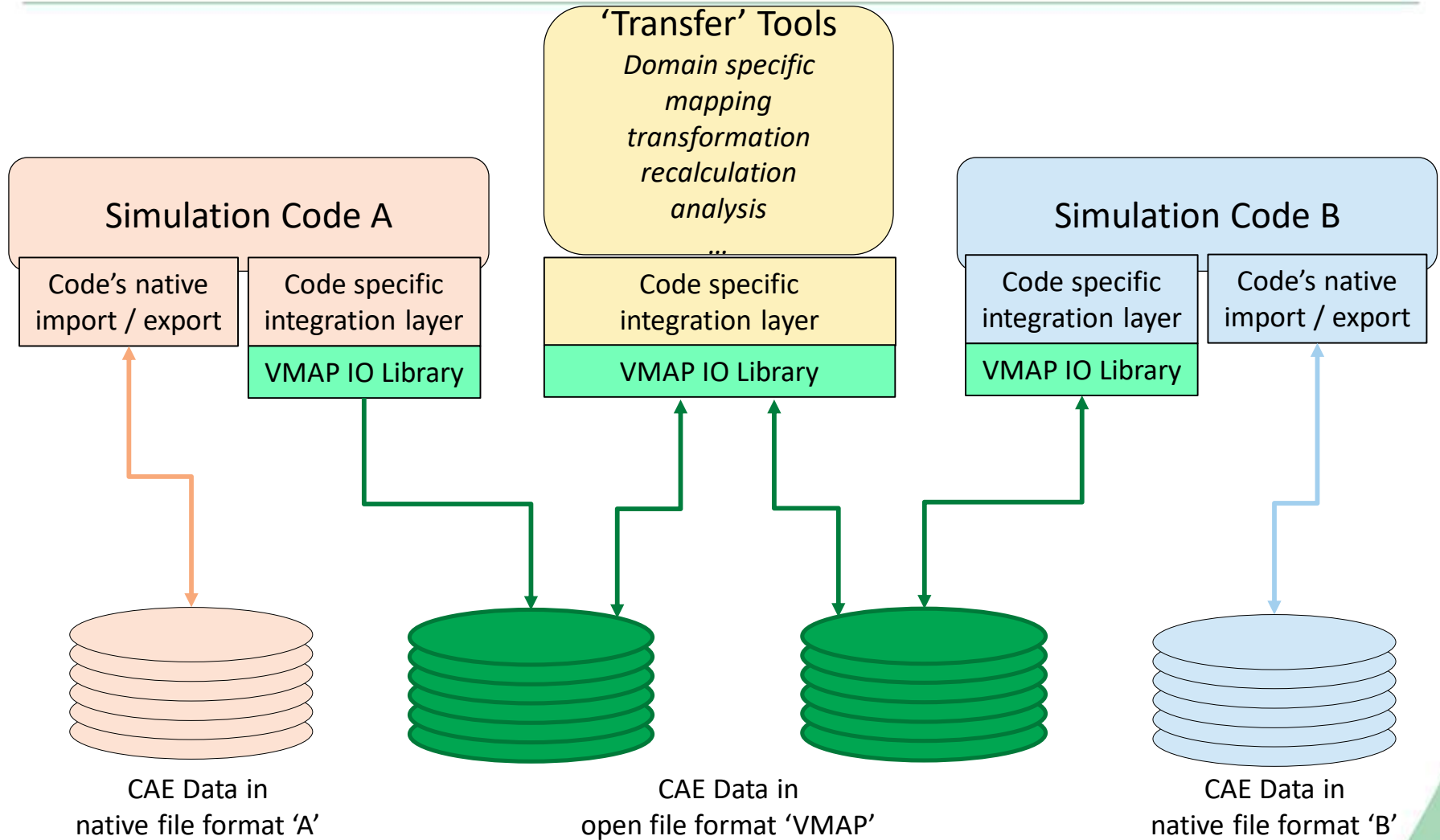
VMAP Interface Concept



HDF5 file format must be a part of VMAP specs

- Other ISVs might use their own IO concepts for VMAP class implementations
- **The file format must be compatible with HDF generated files (part of VMAP specification)**
- End users thus can use any VMAP compatible tool and viewer
- ...

VMAP Approach



Points for Discussion

What kind of standardisation is needed to use an OSP for interoperability?

- Commercial tools for material and manufacturing simulation in 3D continuum mechanics are only available as 'black box' codes
- users cannot change internal details but extend available material models e.g. by adding numerical integration rules for specific discretization element types
- If multiple process steps shall be simulated the user needs a seamless transfer of simulation/result data between commercial tools. In the VMAP project this transfer will be standardized

Points for Discussion

How would you want to use an open framework to fully automatize data transfer between models?

- For a fully automated transfer of data between 3D CAE tools we would first need a common understanding and fully documented implementation details of material models in each of the related codes
- (Unfortunately) the details of material model implementation are core business secrets of the ISVs
- In the midterm an ontology (based on publicly available information) on material model implementation and parametrization could help to automate data transfer

Points for Discussion

What would a framework have to offer so that you would use it regularly?

- Standards for model import and data/result export
- Open definitions on material models
- Good handling to set up complex engineering workflows