

The digital twin for efficient and precise production of concrete modules

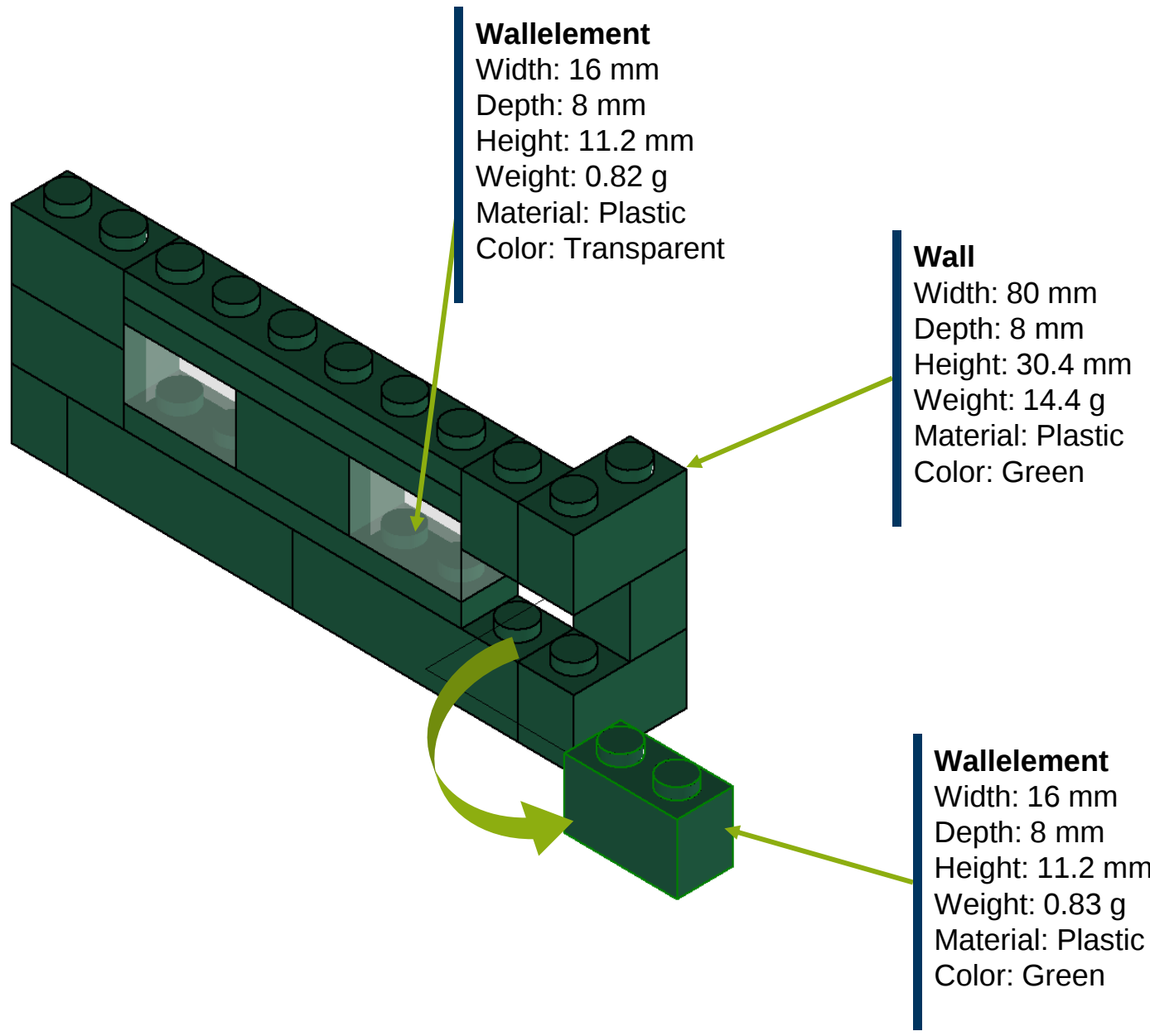
Prof. Dr.-Ing. Detlef Gerhard, Digital Engineering Chair
Prof. Dr.-Ing. Markus König, Chair of Computing in Engineering
Ruhr University Bochum



Motivation

Problem

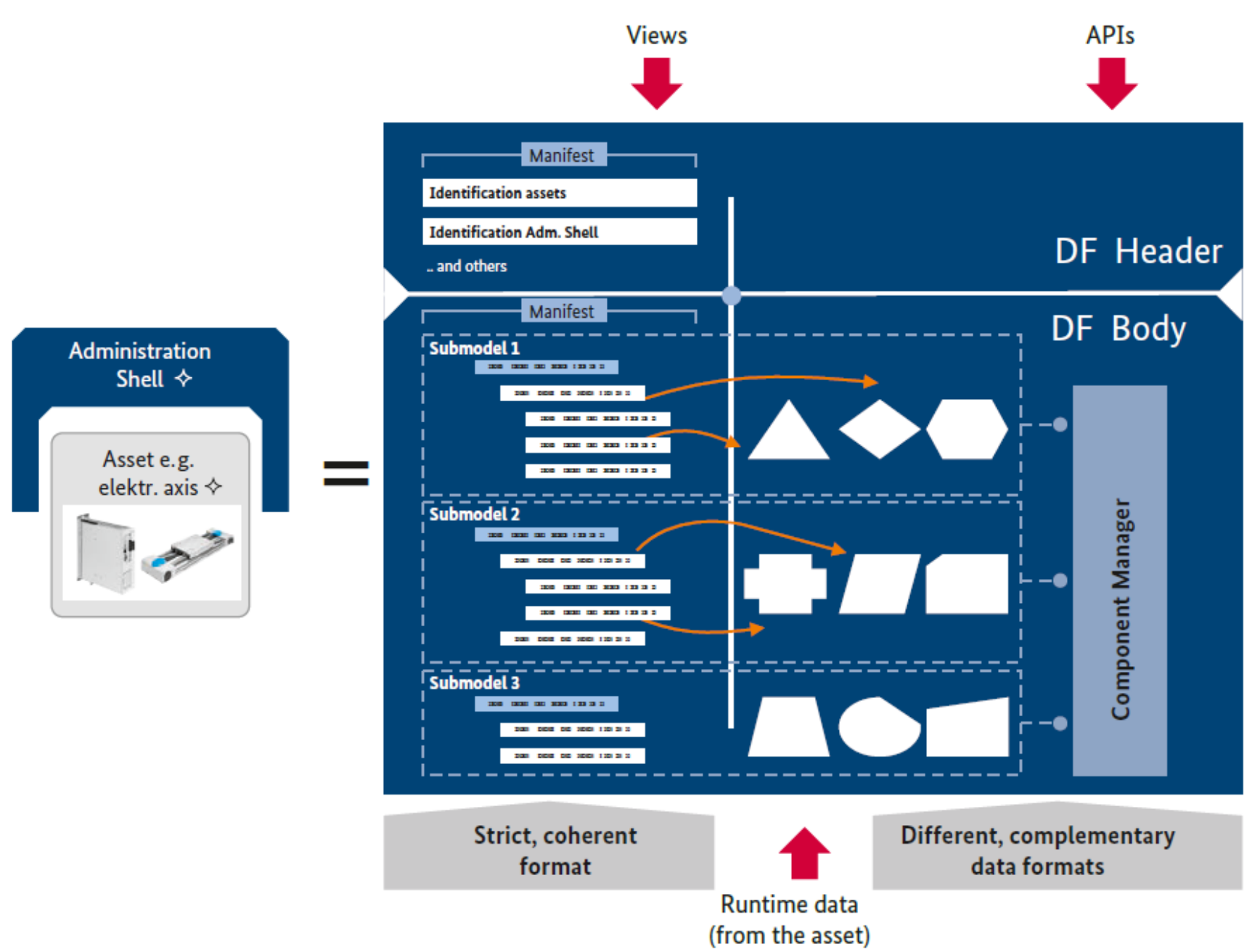
- Production steps in the precast industry are characterized by craftsmanship
 - The use of information and communication technology is the key to increase productivity and efficiency
 - For smooth planning and operation as well as sustainable deconstruction of a building structure, all necessary information must be collected over its life cycle
- The digital twin as an integrated data model is particularly well suited for this task



Goal

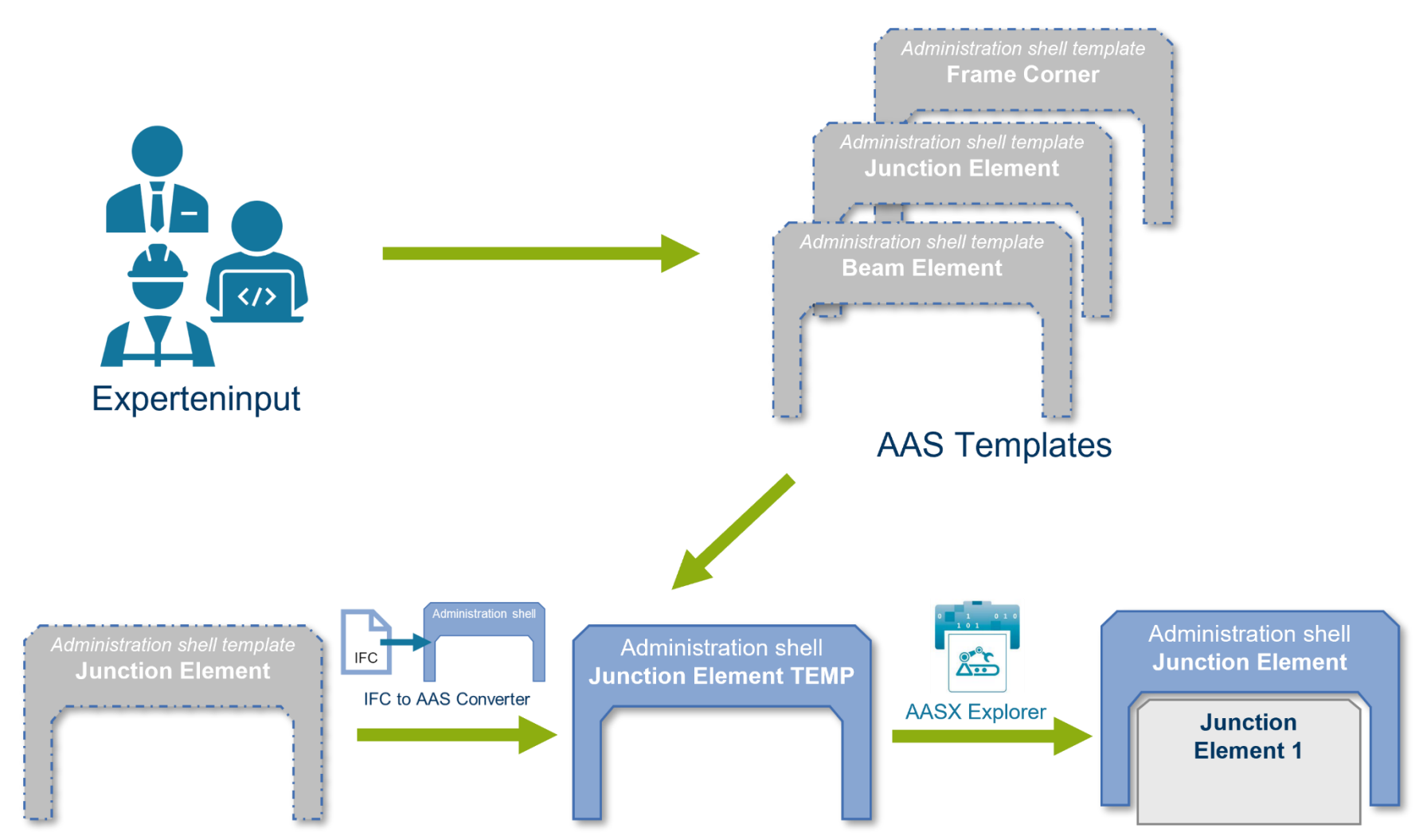
- Combination of current Building Information Modeling concepts with methods from Industrie 4.0 that enable self-organized and decentralized production by using automated production technologies.
- Development of suitable descriptions for digital twins of precast concrete modules
 - Development of a consistent and adaptable data and interaction model for the industrialized, decentralized production of precast concrete modules
 - Definition of requirements regarding function and quality considering the possible uncertainties during production

Methods



Implementation of Administration Shells for precast modules

- Creation of administration shell templates based on expert input and reference to IFC data format
- Part of the data needed to instantiate the administration shells can be extracted from IFC models and stored in the administration shells
- Missing data is added manually so that the initial administration shell is created
- The administration is deployed on a server for interaction and data exchange



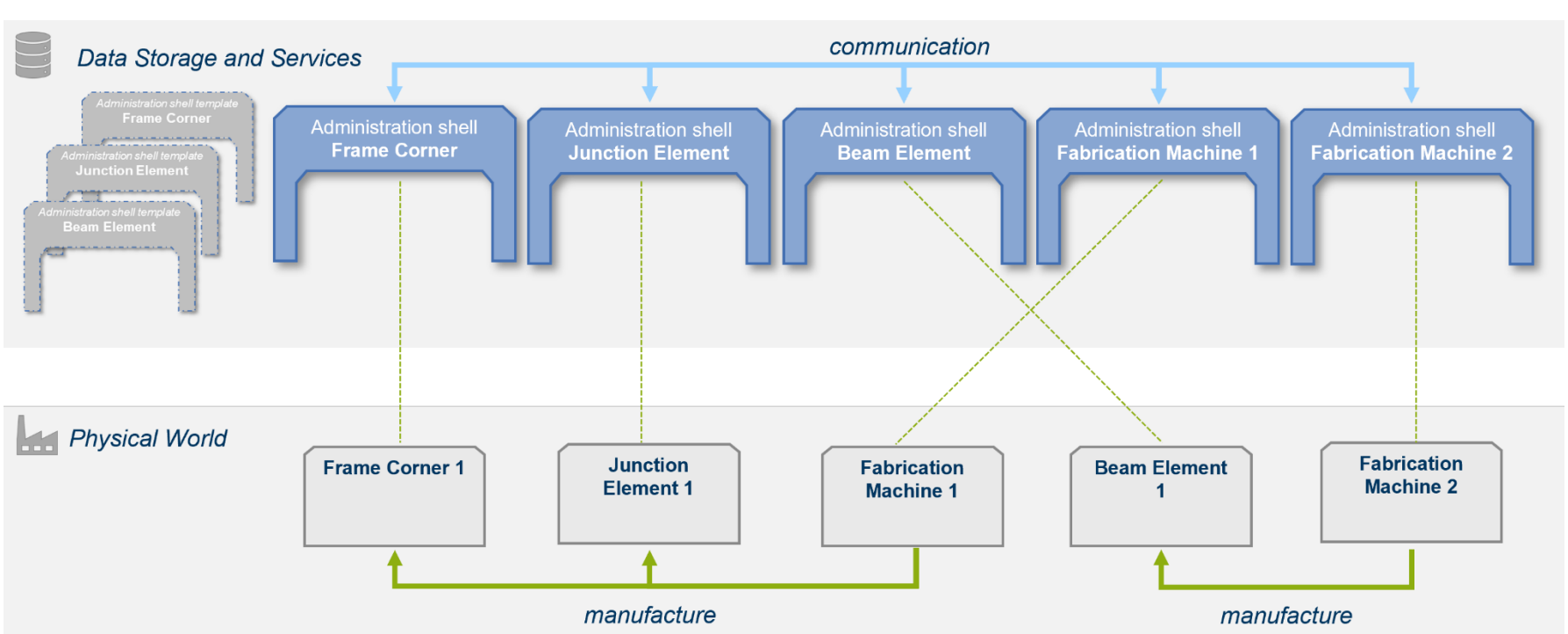
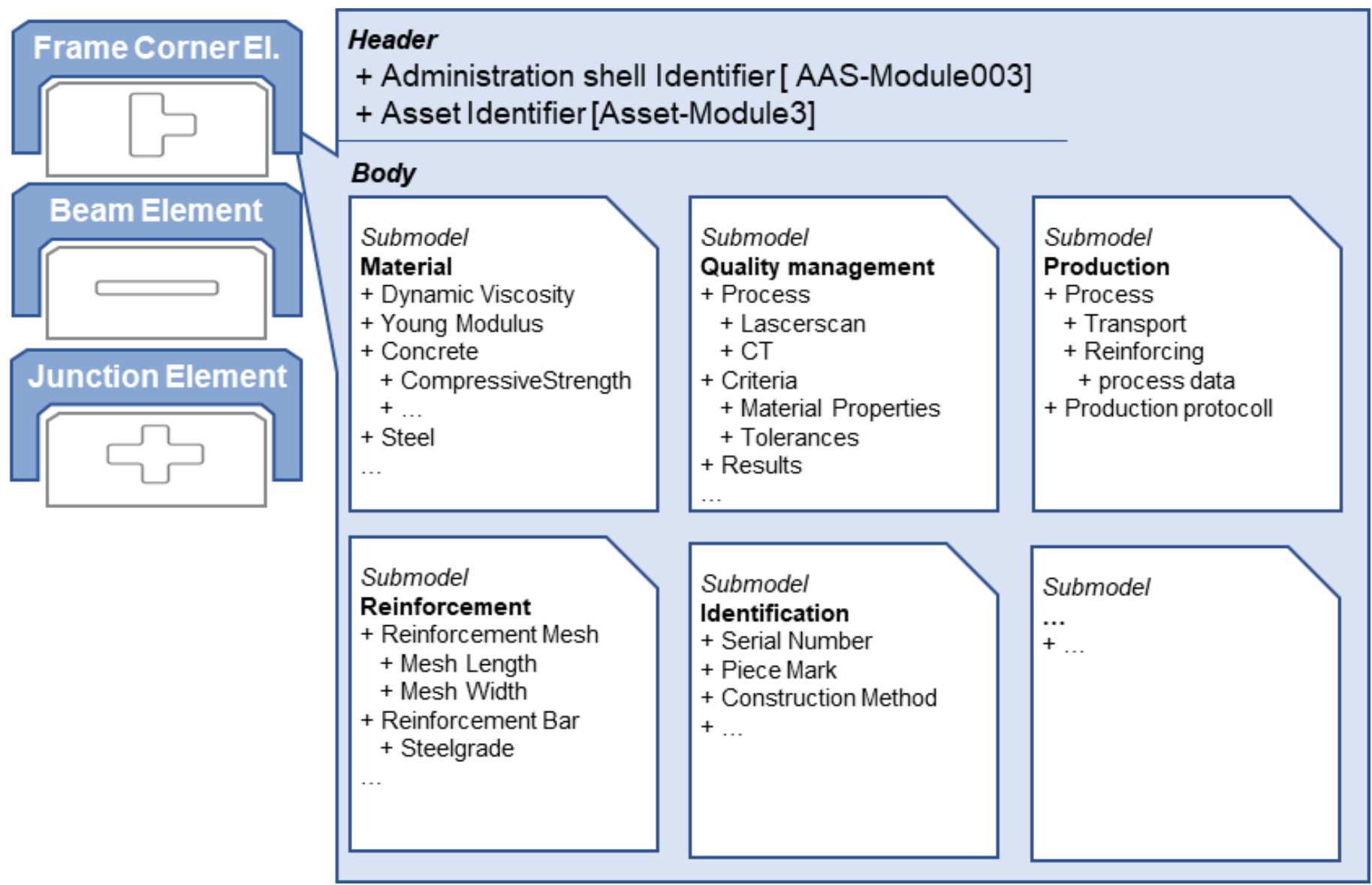
Results

Results

- Set of requirements for the digital twin for precast concrete elements
- Transfer of requirements into administration shell templates
- Application within the benchmark projects of the SPP „Hochbau“, „Brücke“ and „Qualitätssicherung“

Outlook

- Semi-automatic creation of administration shells
- Concepts for the visual representation of the digital twin and its interactions
- Development of query languages for automatic testing of requirements



Publications

Wolf, M.; Vogt, O.; Huxoll, J.; Gerhard, D.; Kosse, S.; König, M. (2021): Lifecycle oriented digital twin approach for prefabricated concrete modules
ECPPM 2021 – eWork and eBusiness in Architecture, Engineering and Construction, 2021, pp. 305-312.

König, M.; Gerhard, D. (2020): Der digitale Zwilling für die schnelle und präzise Fertigung von Betonmodulen.
In: Beton Werk International Nr. 6, 2020, S. 24-26

Gerhard, D.; Huxoll, J.; Vogt, O.; Wolf, M. (2020): Digital twin representations of concrete modules in an interdisciplinary context of construction and manufacturing industry In: Product lifecycle management enabling Smart X, pages 101 - 115

Gerhard, D.; Neges, M.; Wolf, M. (2020): Übertragung vom Konzept des Digitalen Zwillings auf die Produktion von Betonfertigteilen in der Bauindustrie.
ZWF Zeitschrift für wirtschaftlichen Fabrikbetrieb, Sonderausgabe 2020, S.58-61

Contact

Ruhr University Bochum
Digital Engineering Chair
Chair of Computing in Engineering

Oliver Vogt, M.Sc.
oliver.vogt@rub.de

Simon Kosse, M.Sc.
simon.kosse@rub.de

www.rub.de/spp2187/