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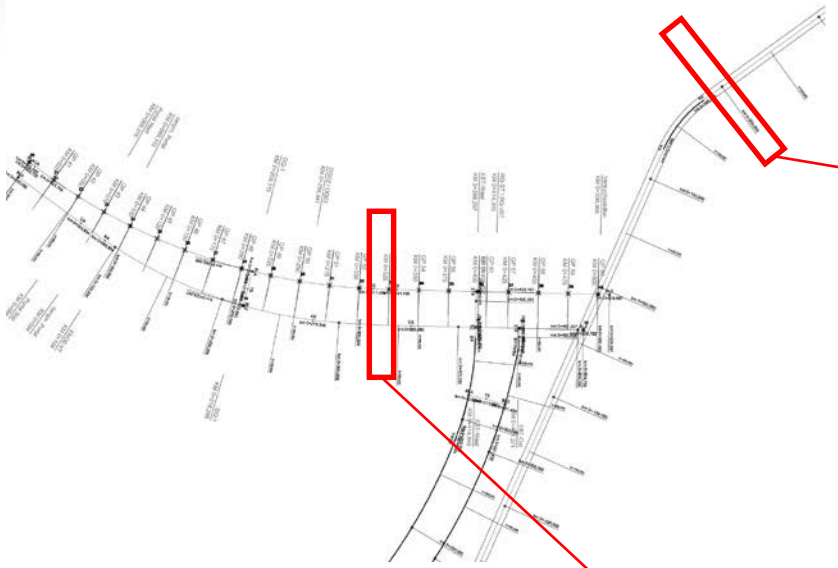
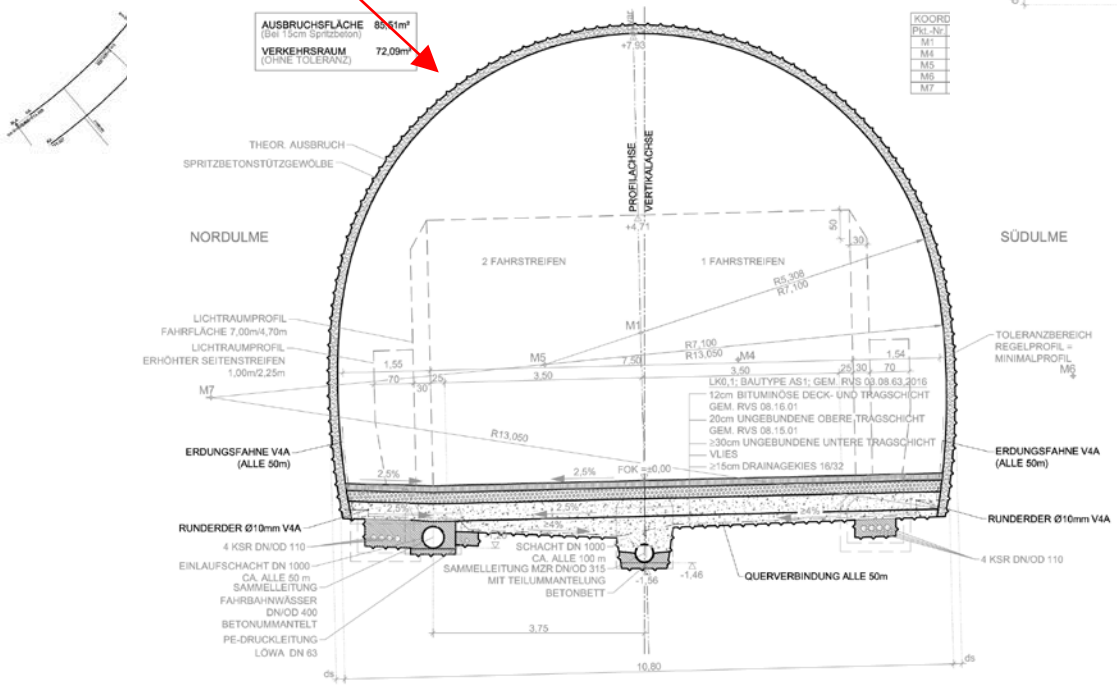
TU WIEN

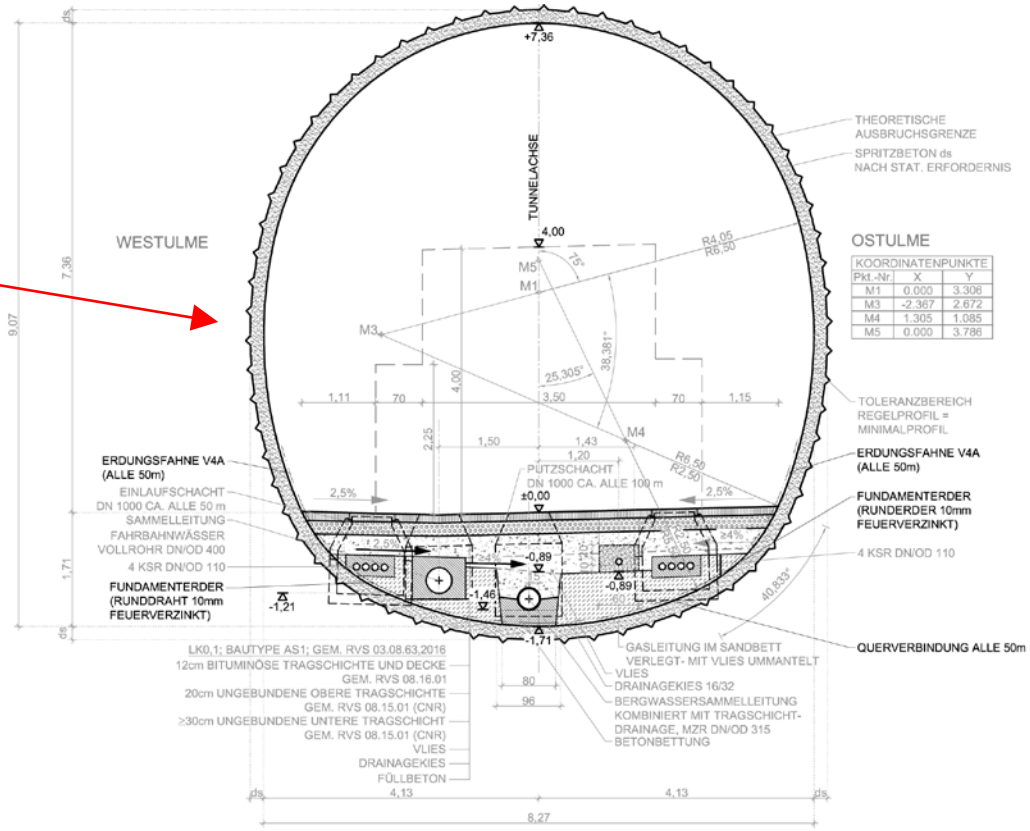
How can digital twin strategies make conventional tunnelling smart?

Alexandra Mazak-Huemer

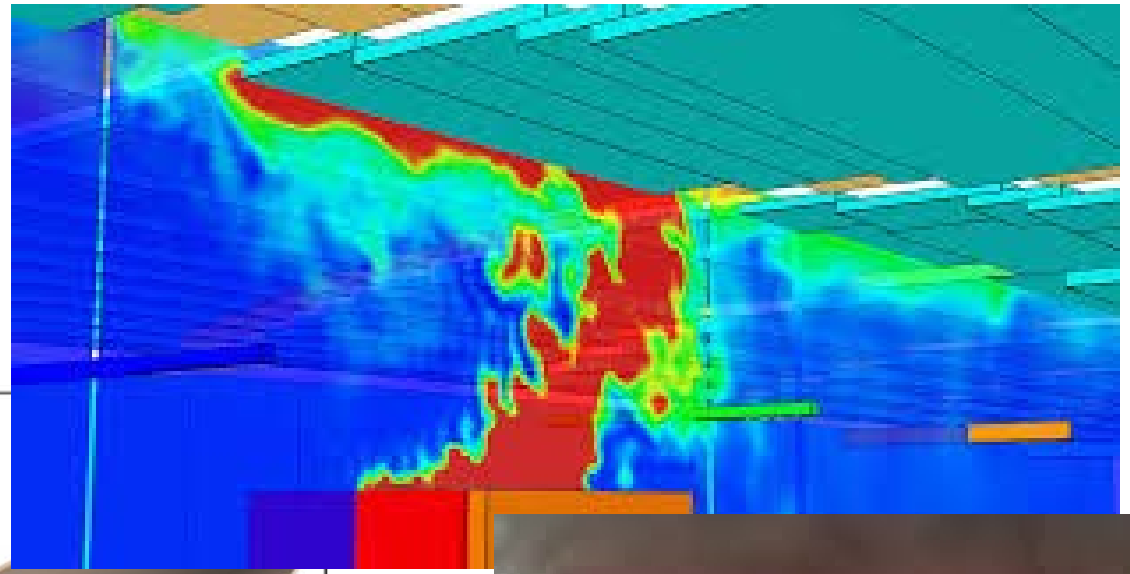
Planning in 2D

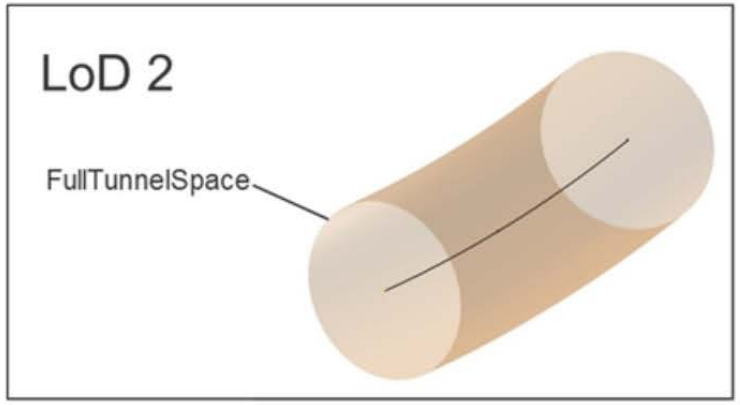


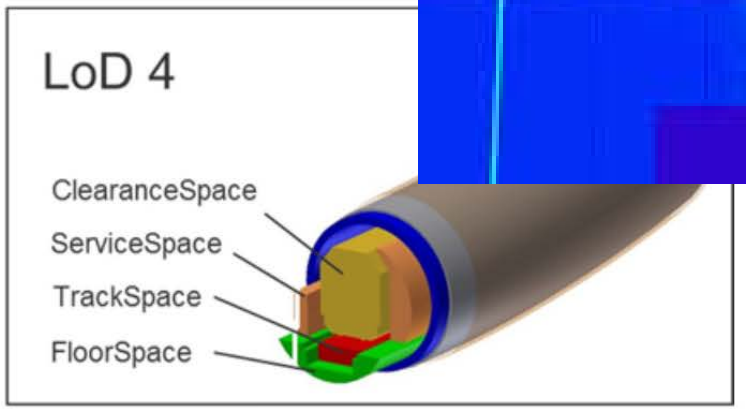


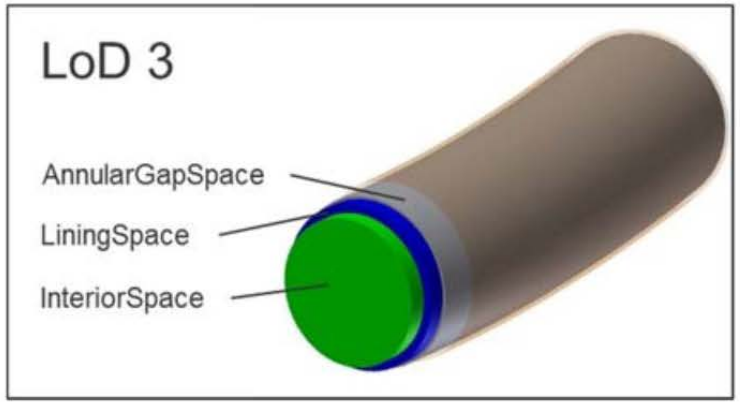


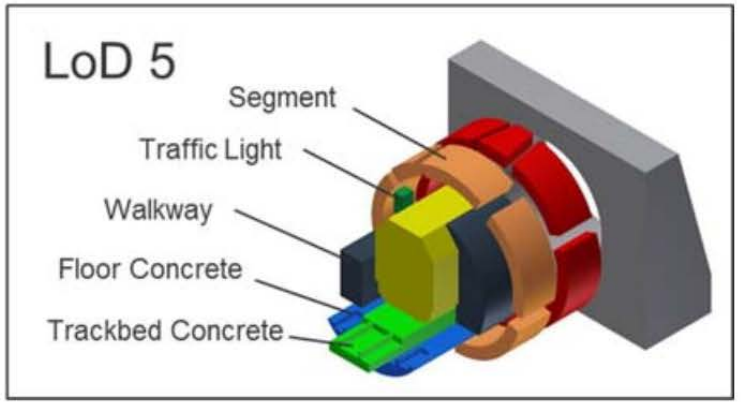
Planning in 3D and Simulation in 3D





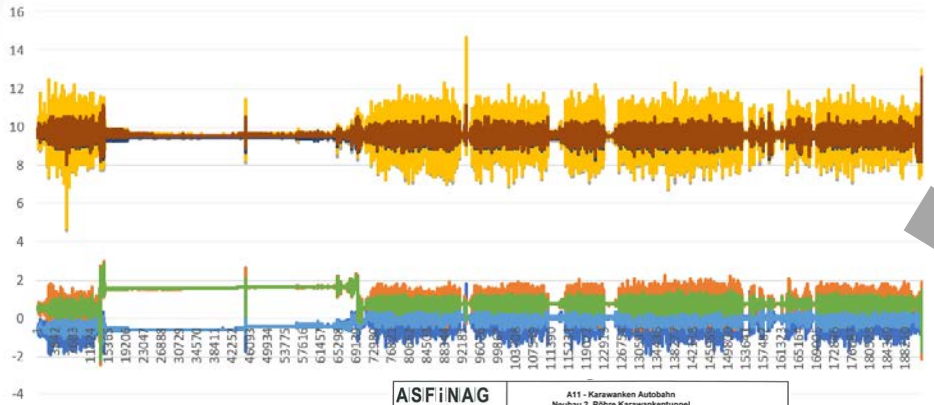


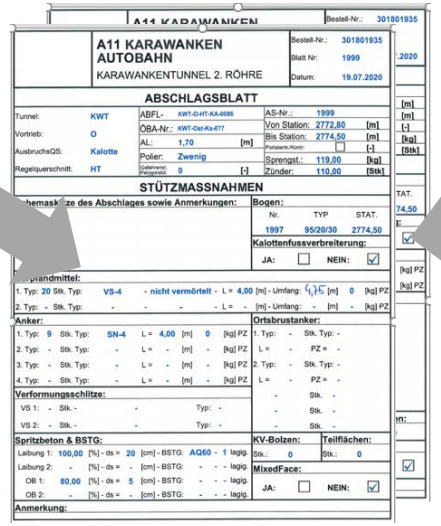


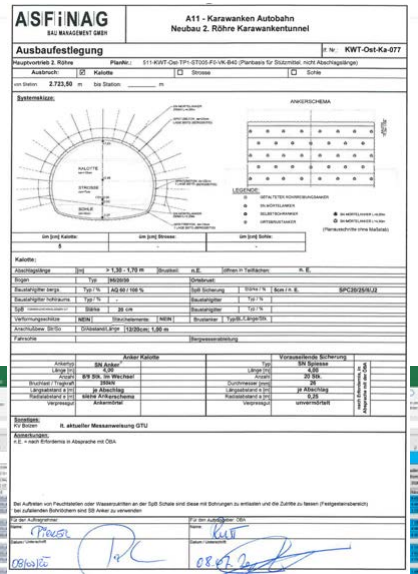


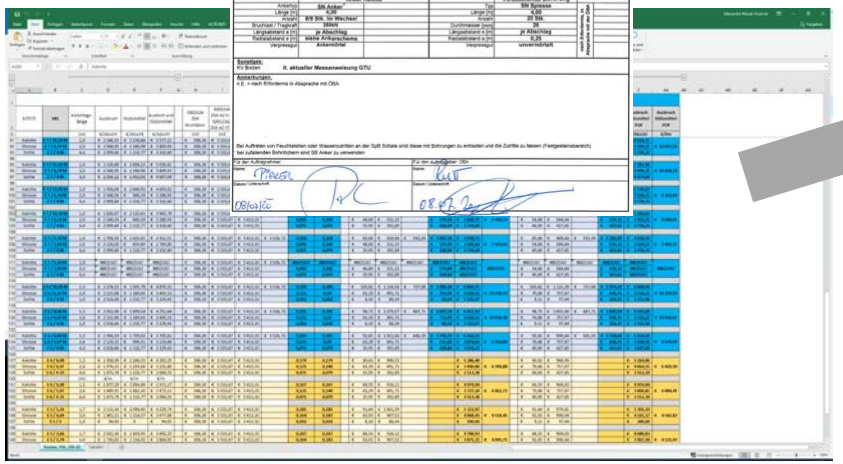
Borrmann, A., T.H. Kolbe, A. Donaubauer, H. Steuer, J.R. Jubierre und M. Flurl (2015a): Multi-Scale Ge-ometric-Semantic Modeling of Shield Tunnels for GIS and BIM Applications. Computer-Aided Civil and Infrastructure Engineering 30 (4), S. 263–281

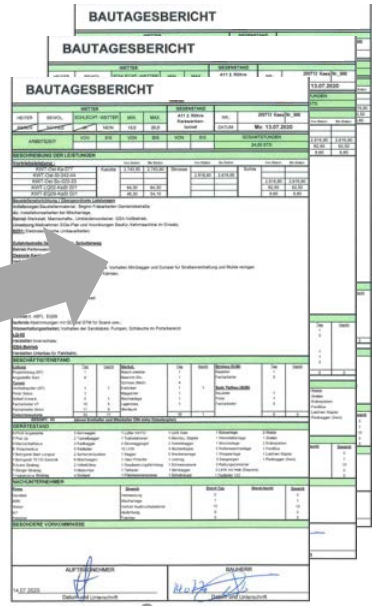
Document management and monitoring



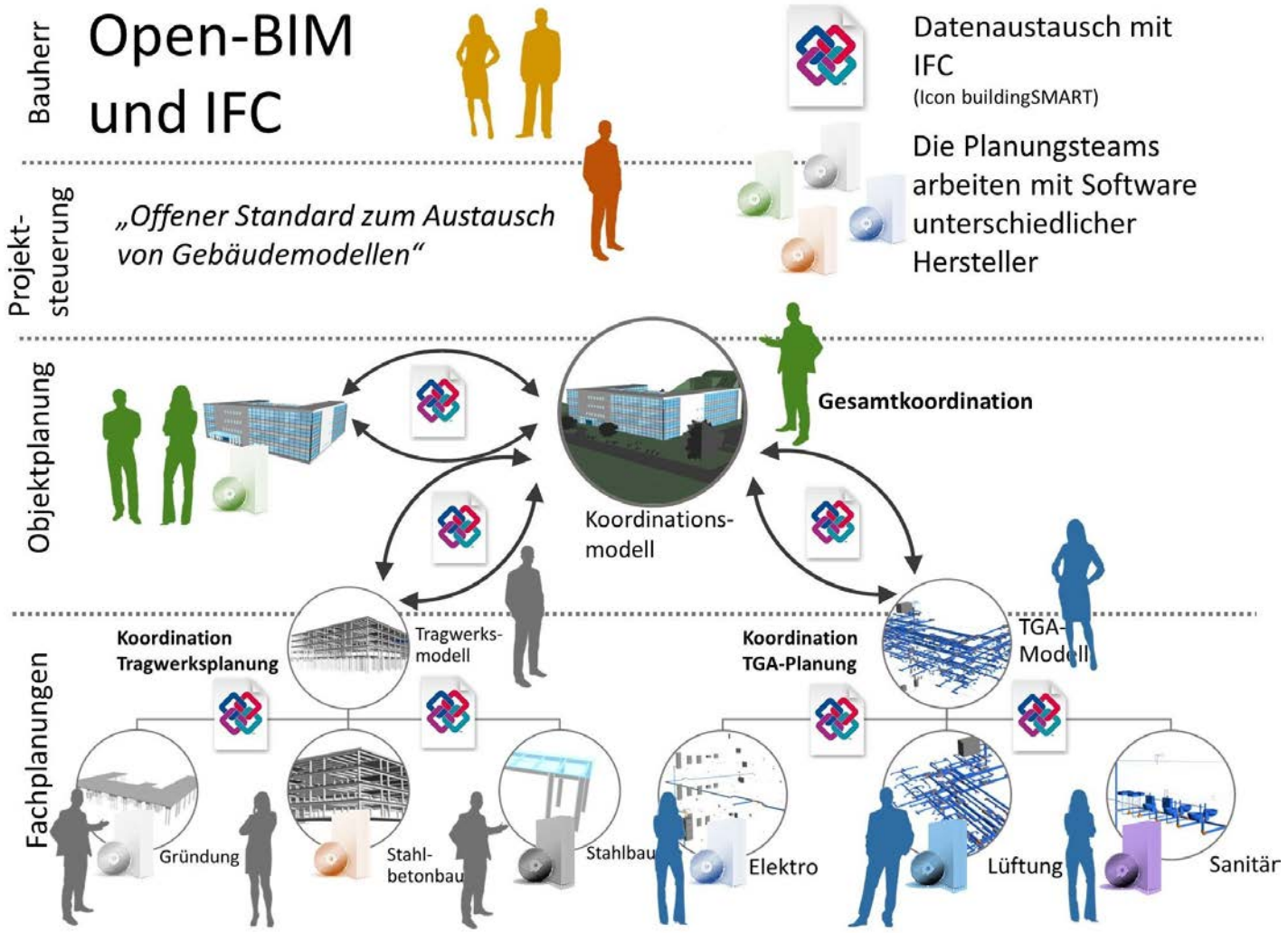








The single source of truth vision of BIM



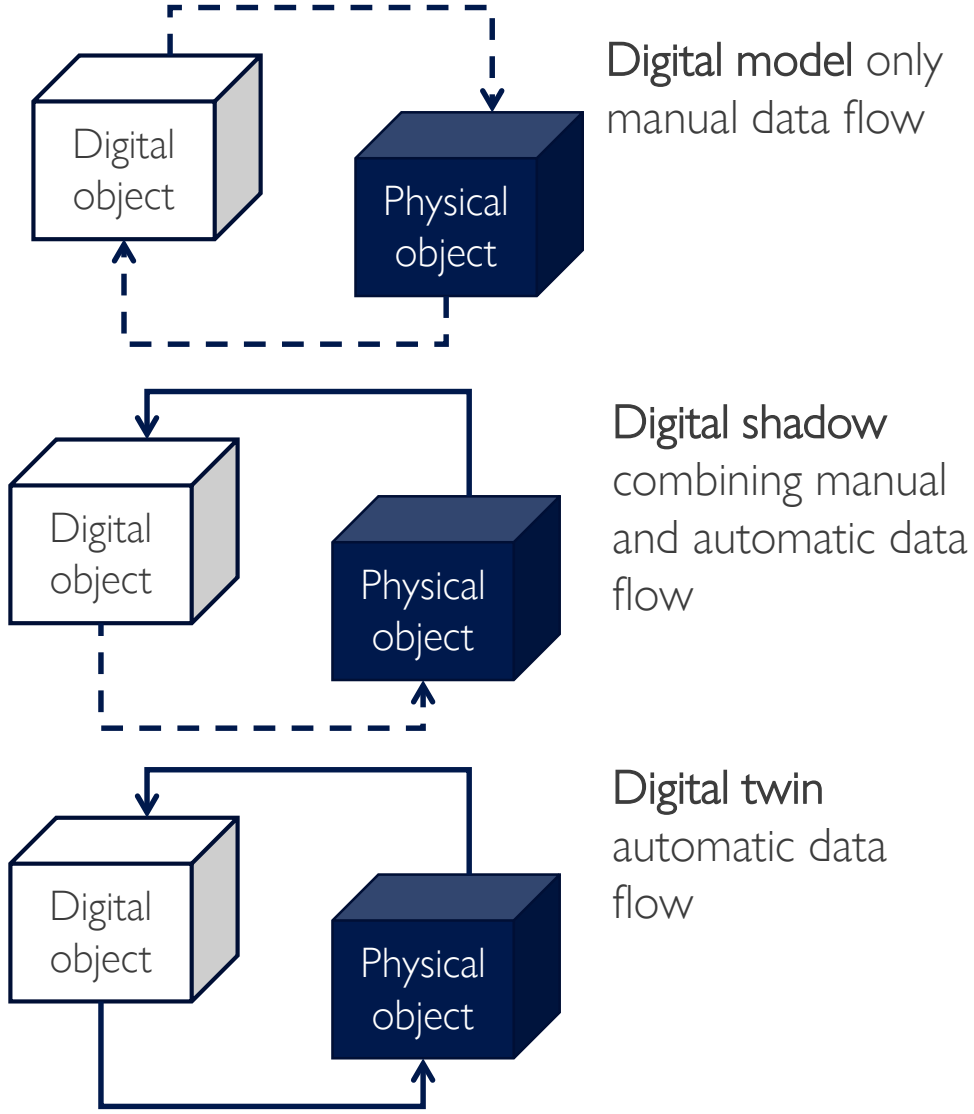
https://www.baunetzwissen.de/bim/fachwissen/grundlagen/was-versteht-man-unter-open----closed-bim-5286041

From digital model to digital twin

Digital model
- documentation
- communication
- simulation
- design

Digital shadow
- state recognition
- runtime monitoring
- conformity checking

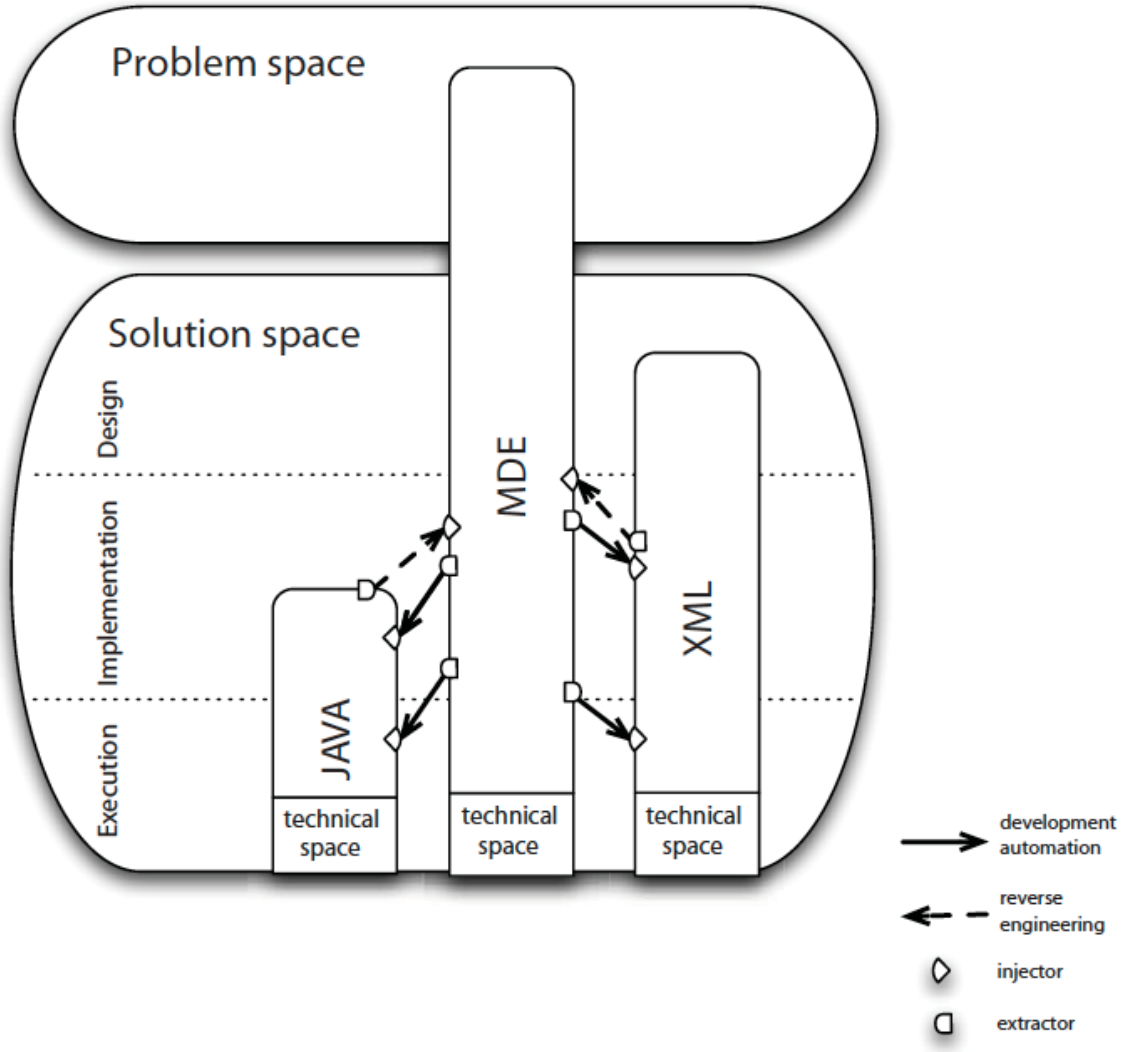
Digital twin
- continuous adaption
- rollback
- autonomous decision making



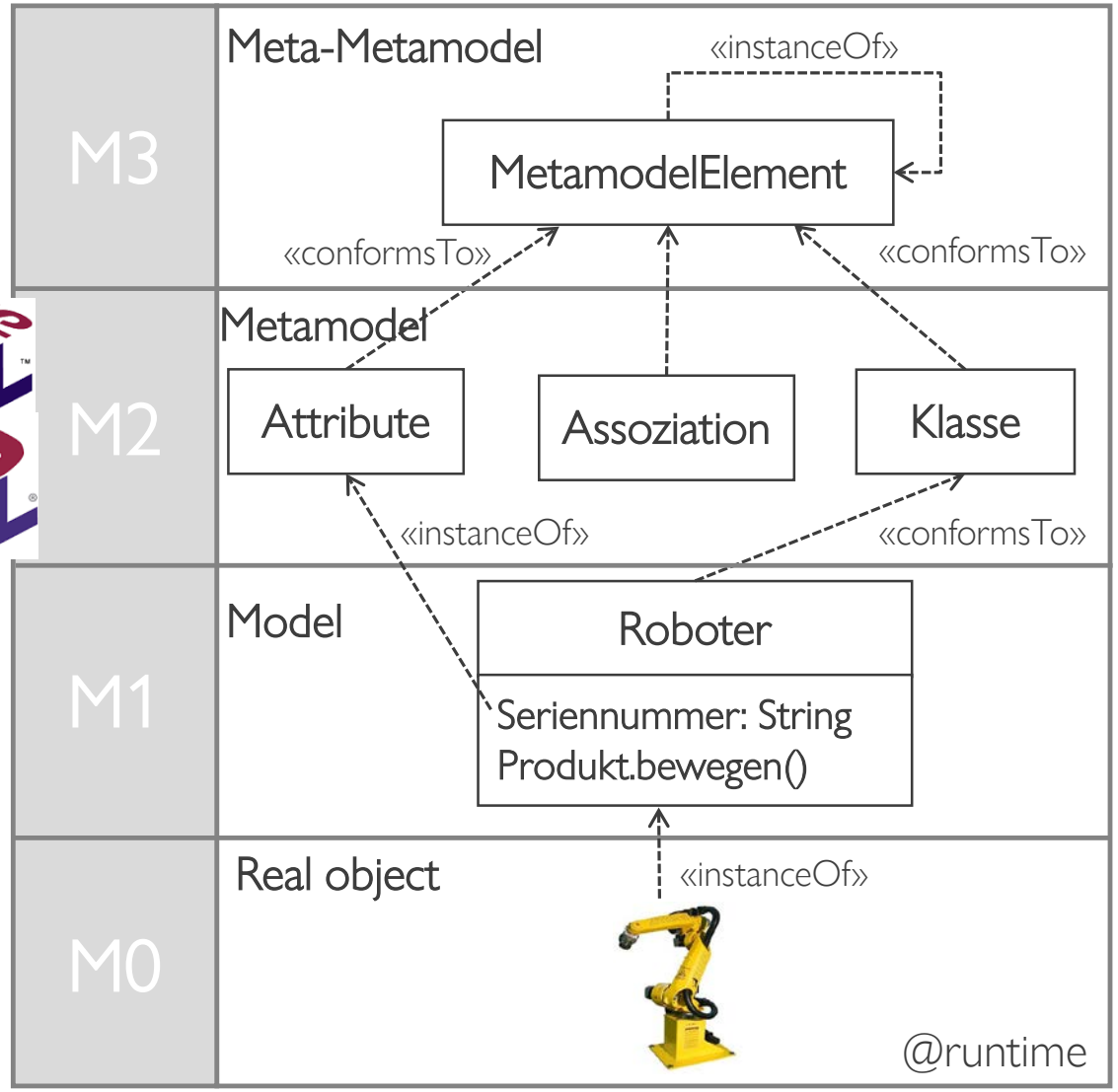
Digital model. Image adapted from Kritzinger, W. et al. (2018). "Digital Twin in manufacturing: A categorical literature review and classification.", Elsevier, IFAC-PapersOnLine, 51(11), 1016–1022

Model-driven software and system development as key

- The **problem space** is defined as the subject area that needs to be studied in order to solve a specific problem.
- The **domain model** is the conceptual model of the problem area (defining the scope).
- **Technical spaces** represent specific working contexts for the specification, implementation as well as deployment of the application.



Comparison of MDE and IFC



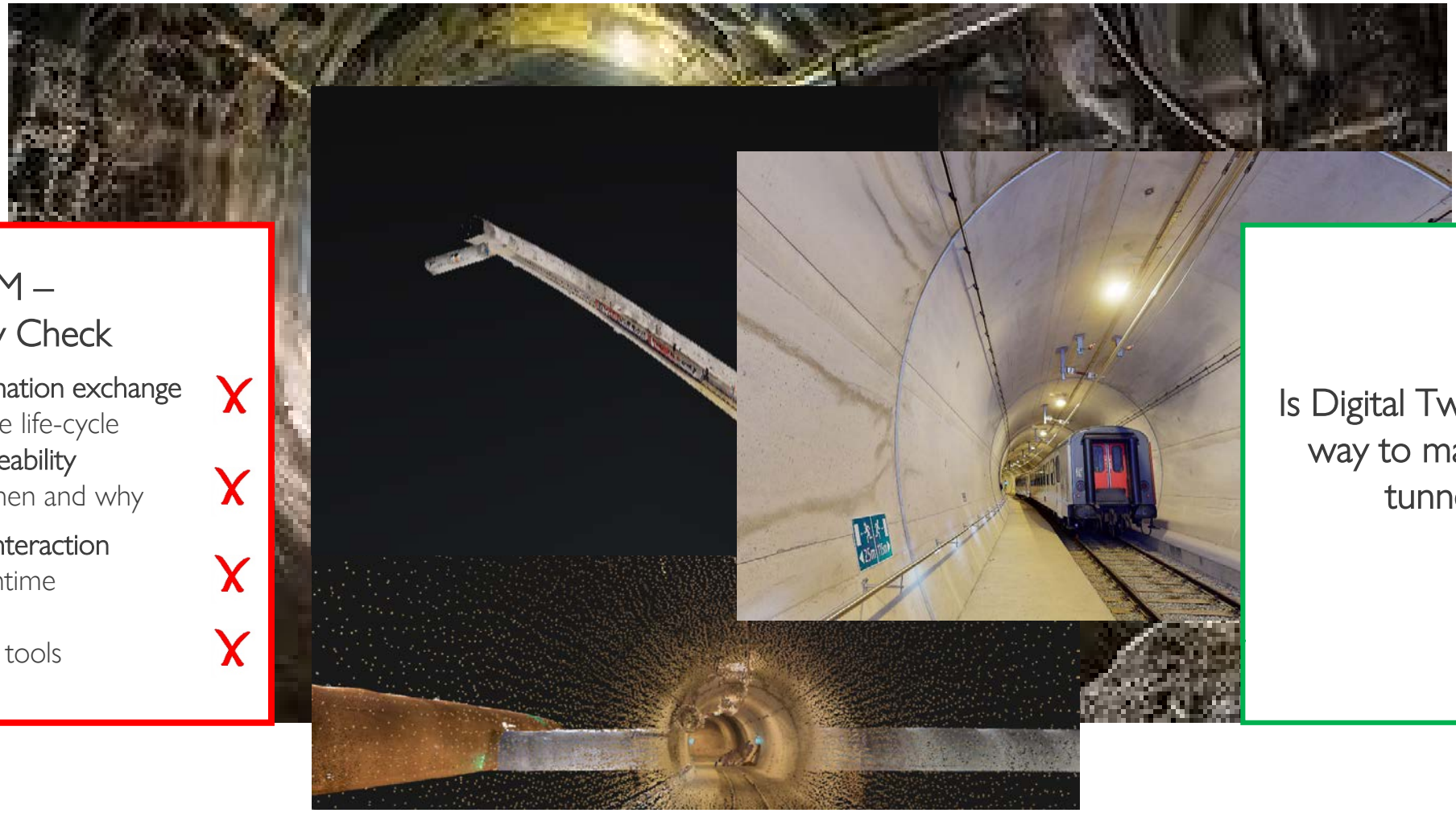
IFC4

IFC4

IFC4

- over 1000 types
- unlimited property and quantity sets

Reality check



BIM –
Reality Check

(1) Seamless information exchange throughout the life-cycle X
(2) Complete traceability who, what, when and why X
(3) Collaboration interaction virtual and runtime X
(4) Data exchange across various tools X
(5) …

Is Digital Twin Engineering the way to make conventional tunnelling smart

?