2022 Annual INCOSE international workshop
HYBRID EVENT
Torrance, CA, USA
Jan 29 - Feb 1, 2022

MBSE Round-robin overview – Richard Martin

IEC 63339 Unified smart manufacturing reference model

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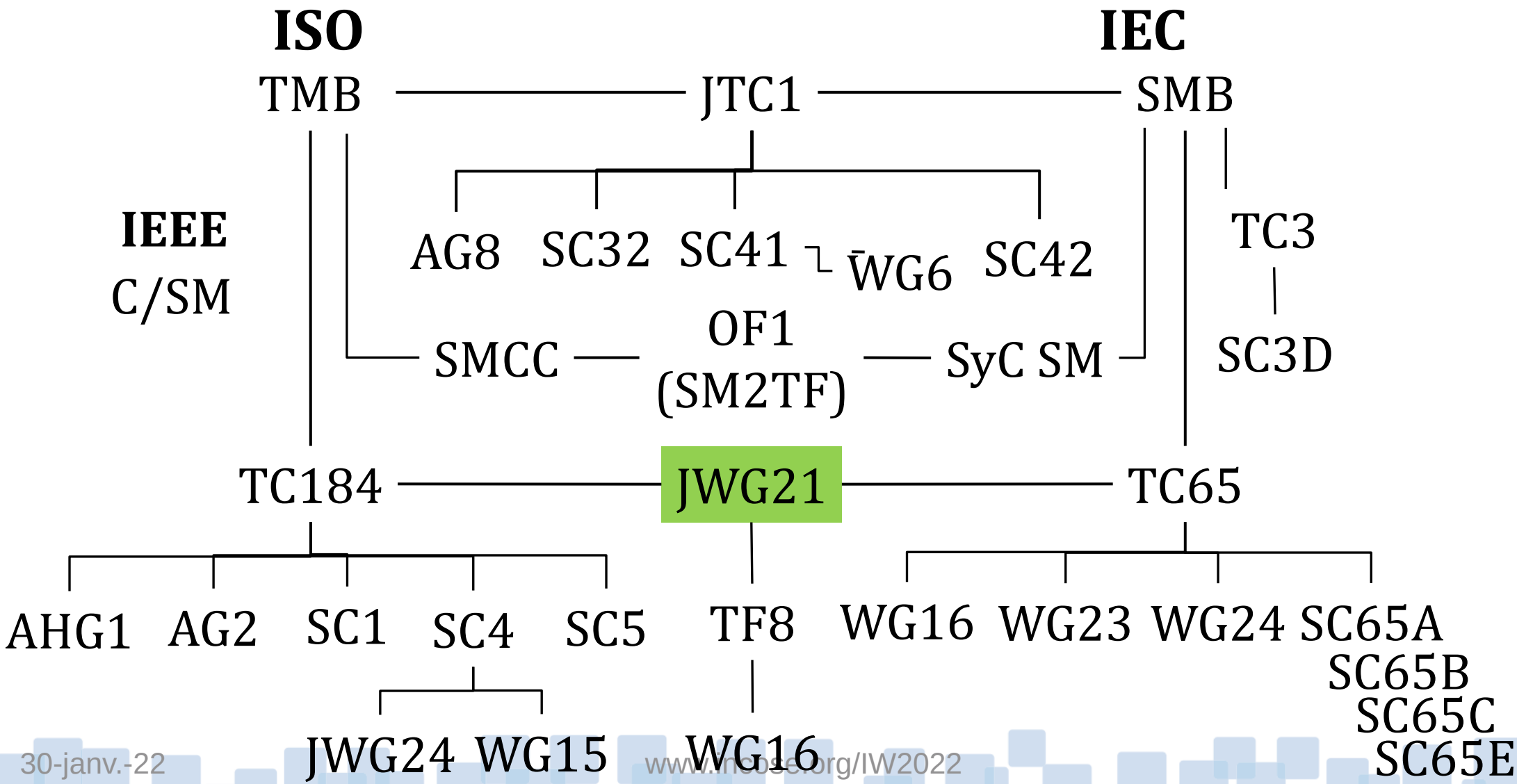
IEC TC65 – ISO TC184 JWG21 realm

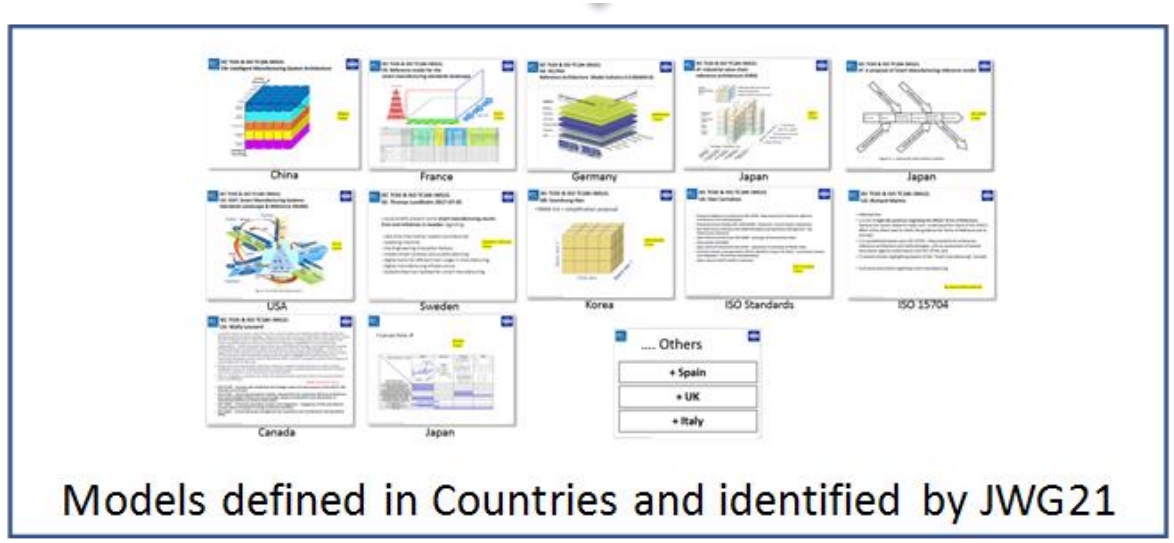


JWG21 ToR and work products

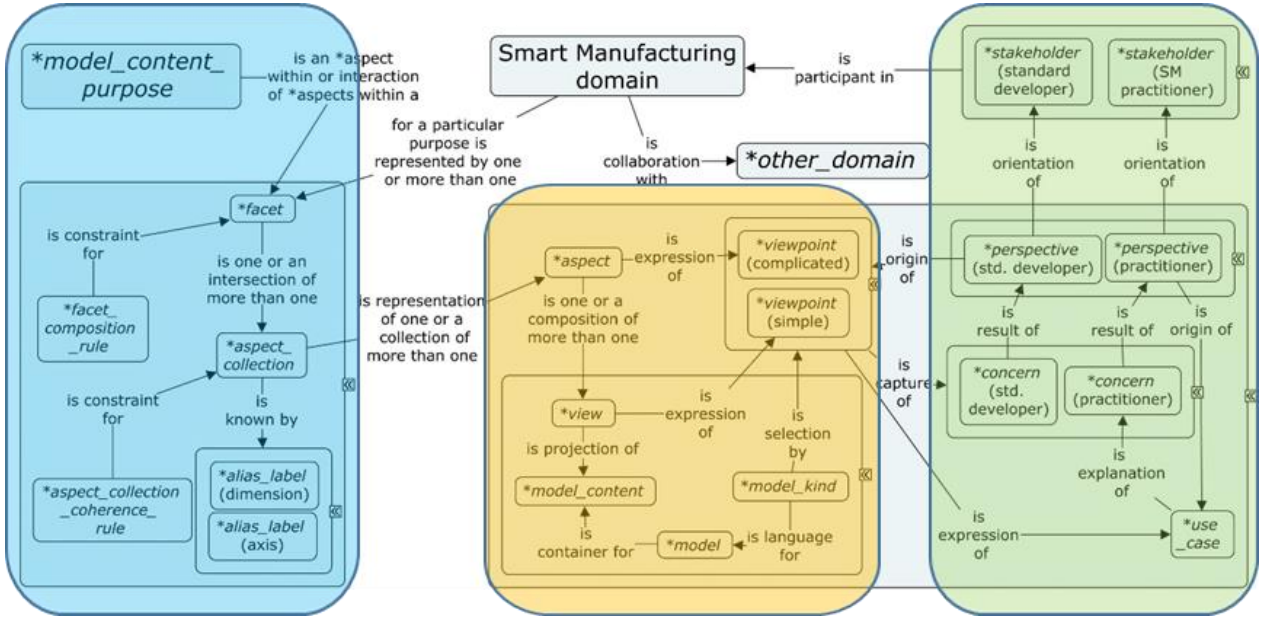
- JWG shall prepare a **standardized unified Reference Model** to support ISO TC184 and IEC TC65 activities in Smart Manufacturing.
- The Reference Model shall comprise a **single model, possibly with a set of consistent and coherent sub-models**, and align with the requirements of stakeholder groups, including manufacturing system users, suppliers, integrators, standardisers, and consumers of manufactured products.

- IEC TR 63319: A **meta-modelling analysis approach** to smart manufacturing reference models. Approved in 2020-10, To be published in 2022-03.
- IEC 63339: Unified reference model for smart manufacturing is a **set of requirements and specifications** for smart manufacturing reference models .

IEC 63319 TR result



Models defined in Countries and identified by JWG21



URMSM modelling framework & semantic modelling

provides normative requirements for

SMRM - Smart manufacturing reference model

provides reference for

SMIM- Smart manufacturing implementation model

Heavy influence from ISO/IEC/IEEE 42010 & ISO 15704

Unifying theme elements

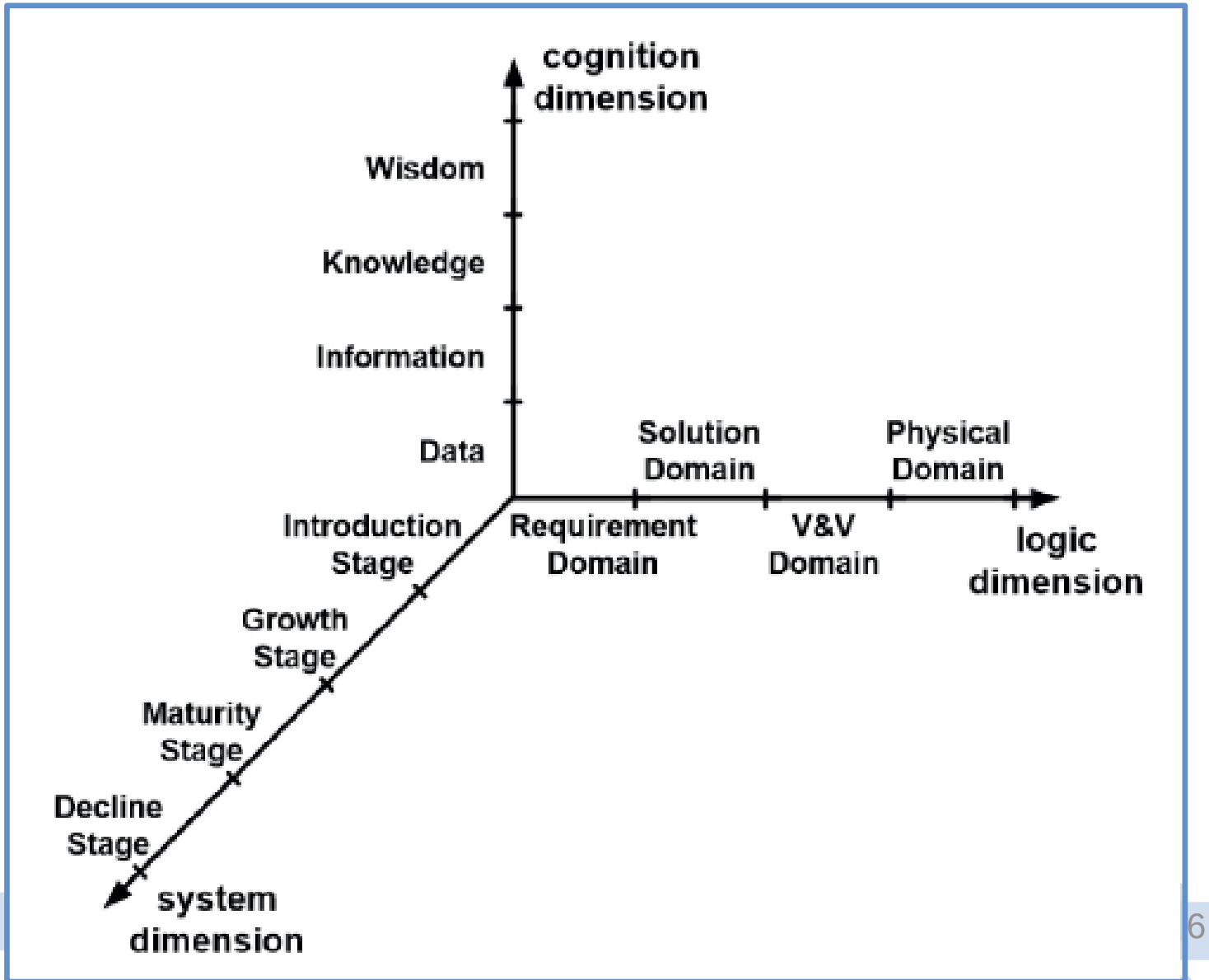
- State reference model context and purpose
- Utilize semantic models of aspects identified as characteristics in the stated context relative to the stated purpose
- Collect aspects into coherent modelling dimensions, which then has its own semantic model
- Arrange dimensions into meaningful facets to understand aspect interactions
- Keep aligned with 63316 meta-model and URMSM formal model
- Enable heterogeneous ways to model smart manufacturing both graphically and mathematically

Aspects, dimensions, facet – 24641 example

13 aspects – wisdom, knowledge, information, data, introduction stage, growth stage, maturity stage, decline stage, requirement domain, solution domain, V&V domain, physical domain

3 dimensions – cognitive, system, logic

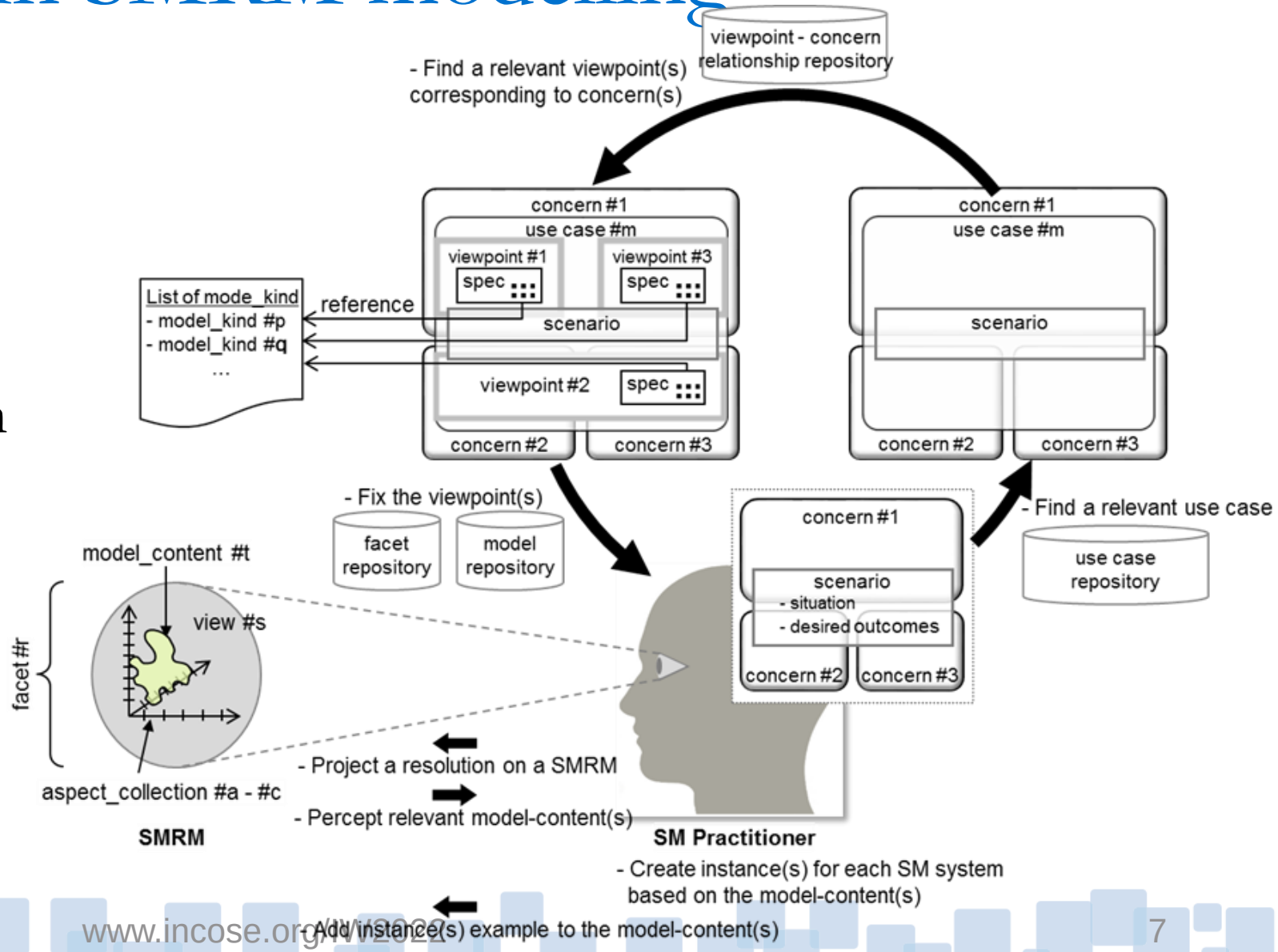
1 facet – MBSSE Reference Framework



Use of URMSM in SMRM modelling

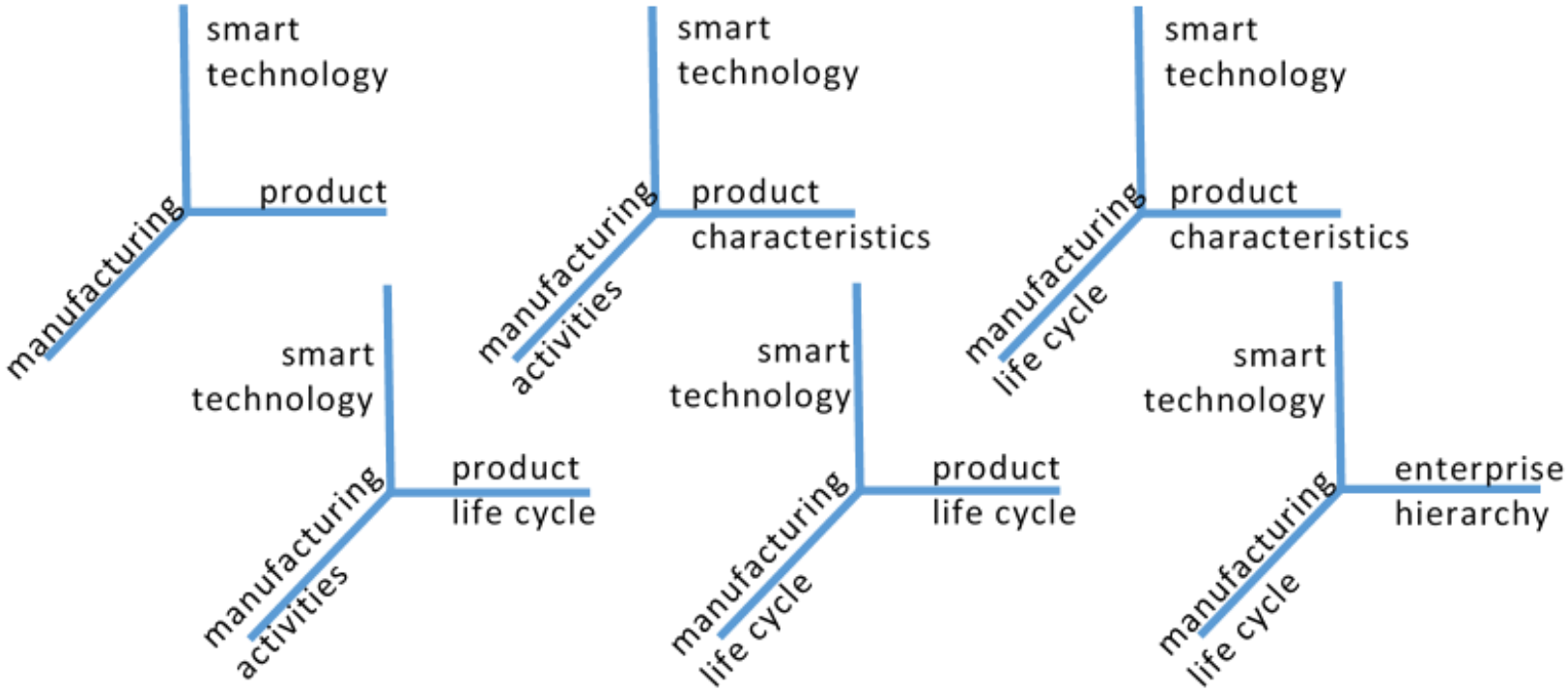
Semantic content of an SMRM needs to address the concerns of practitioners, often stated as a use case.

URMSM specifies the ways in which semantic content should be developed and deployed to support modelling activities of standards developers and practitioners.



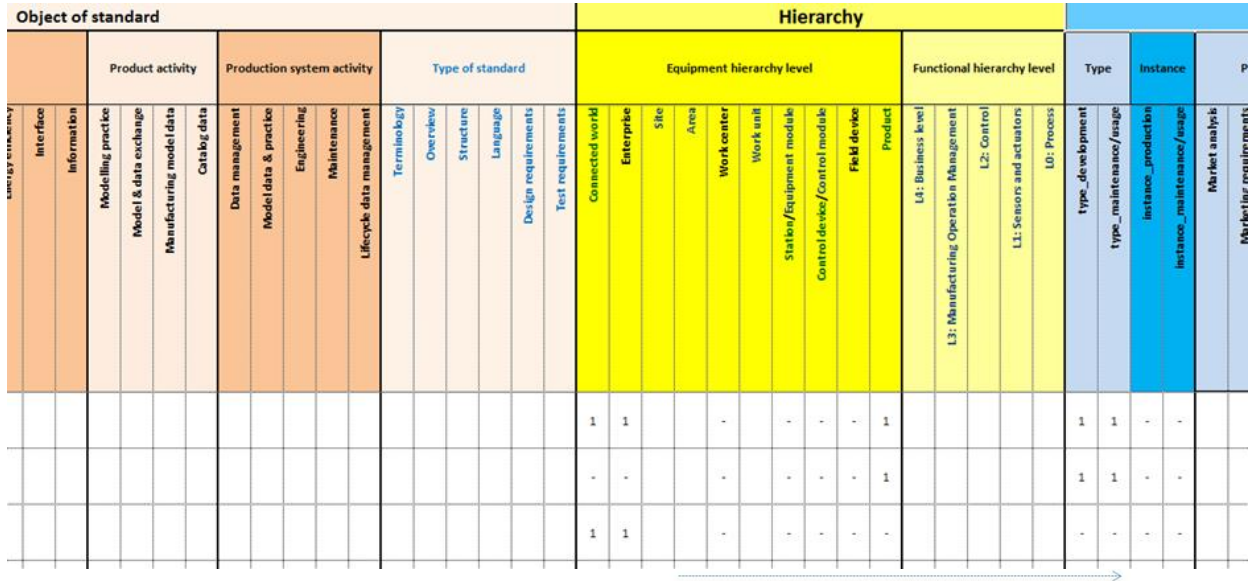
Families of reference models – 3D examples

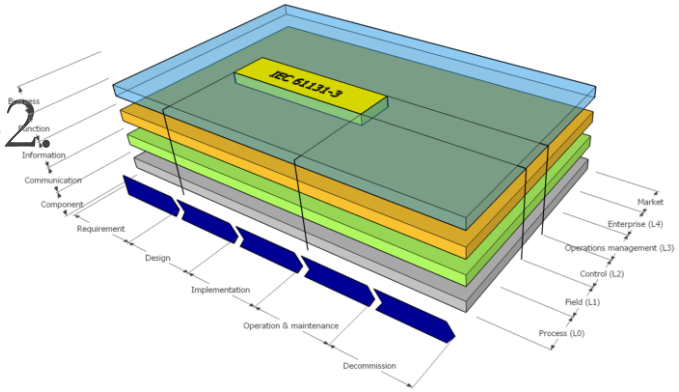
- Multiple facets allow analysis or synthesis using aspects in many different dimensions.
- Modelling purpose determines which aspect interactions are meaningful.

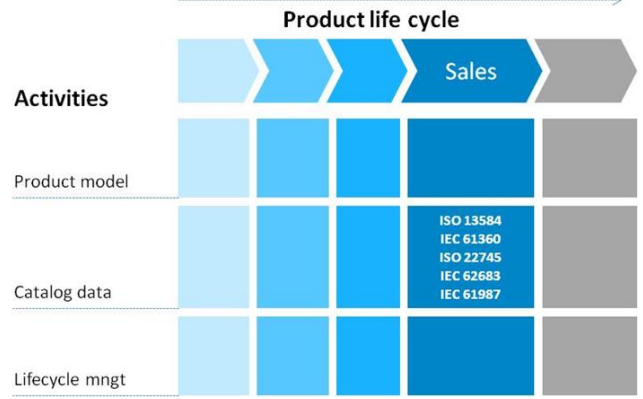


Purpose specific content representation

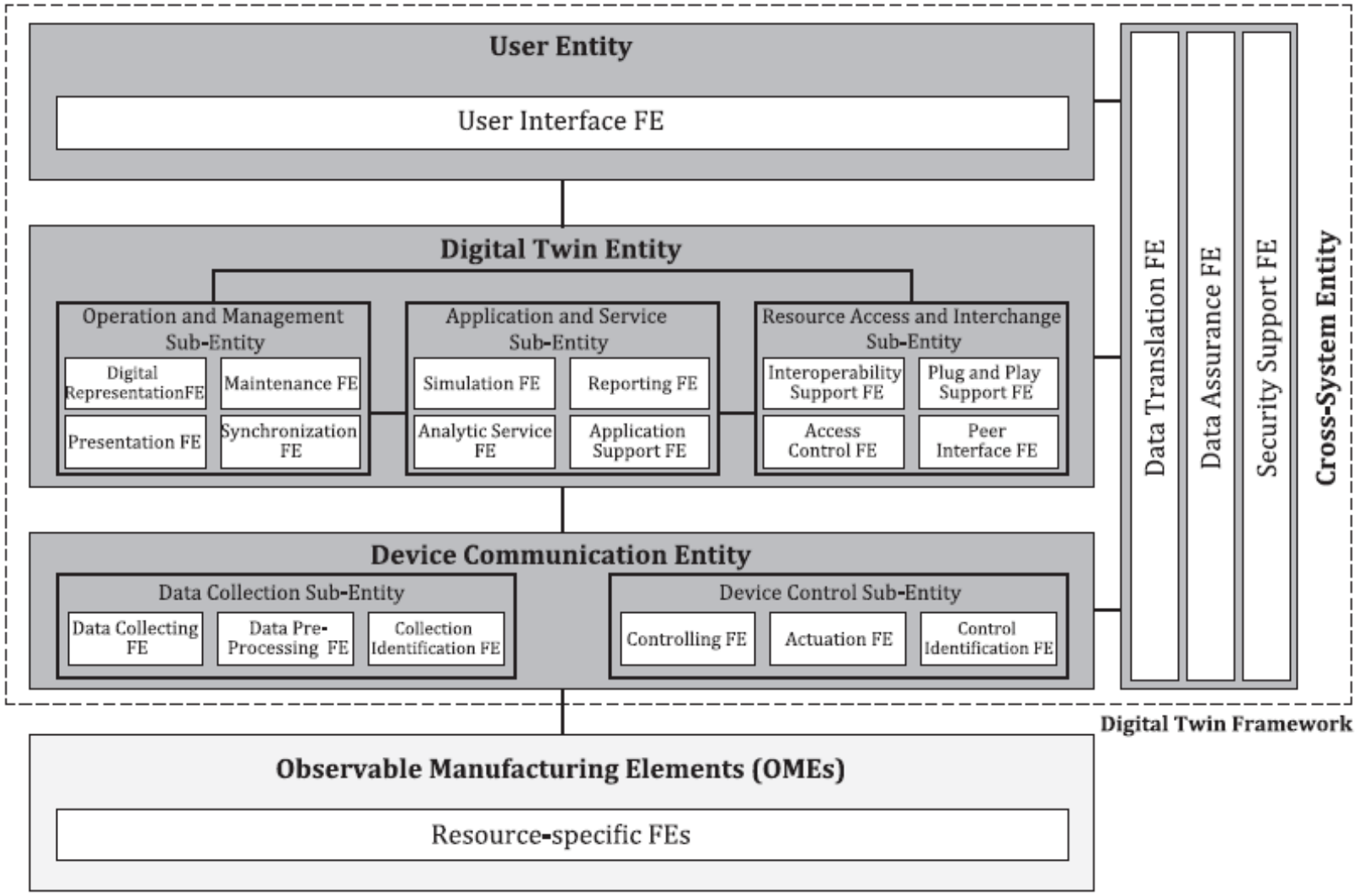
- The same model content can appear in different representations to align with modelling purpose.
- The images are three ways of using content specified semantically in IEC 63306-1 and catalogued in IEC 63306-2.





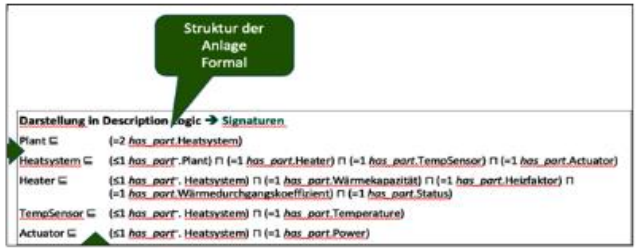


Many aspects and dimensions of digital twin

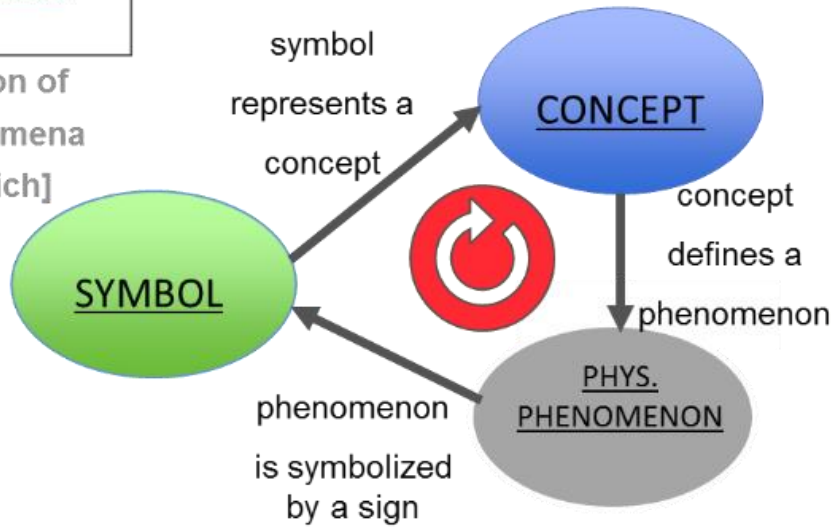


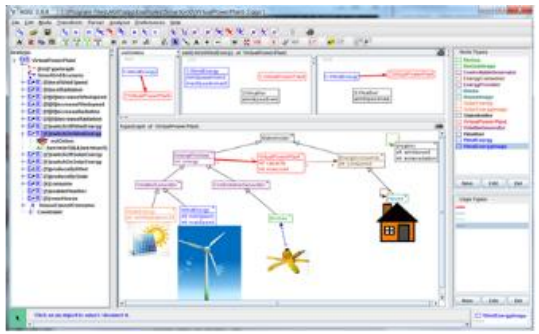
- More than 3 dimensions require different representational forms.
- The semantic models for digital twin are found in ISO 23247 Parts 1 – 4.

Using semiotics to get Smart

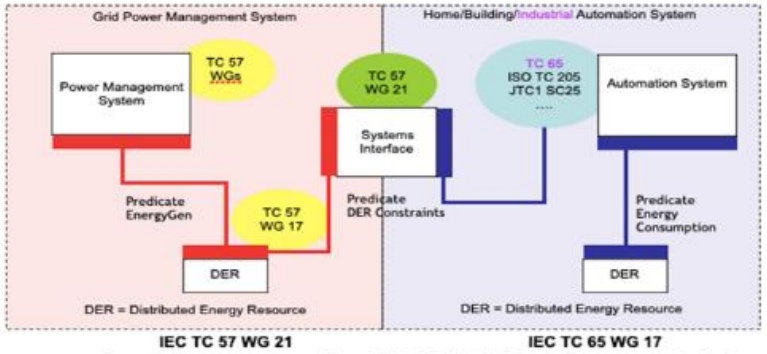


Formal ontological description of TC57||TC65 Smart Grid Phenomena [OVG University Prof. Diedrich]





Graph-theoretical Simulation of TC57||TC65 Smart Grid Phenomena [TUB DaIN Lab]



Architecture of a TC65||TC57 Smart Grid [RAMI4.0]

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