Ontology Engineering for Systems Engineering
Low Hanging Fruits: PLM Data Models

Ontology Summit
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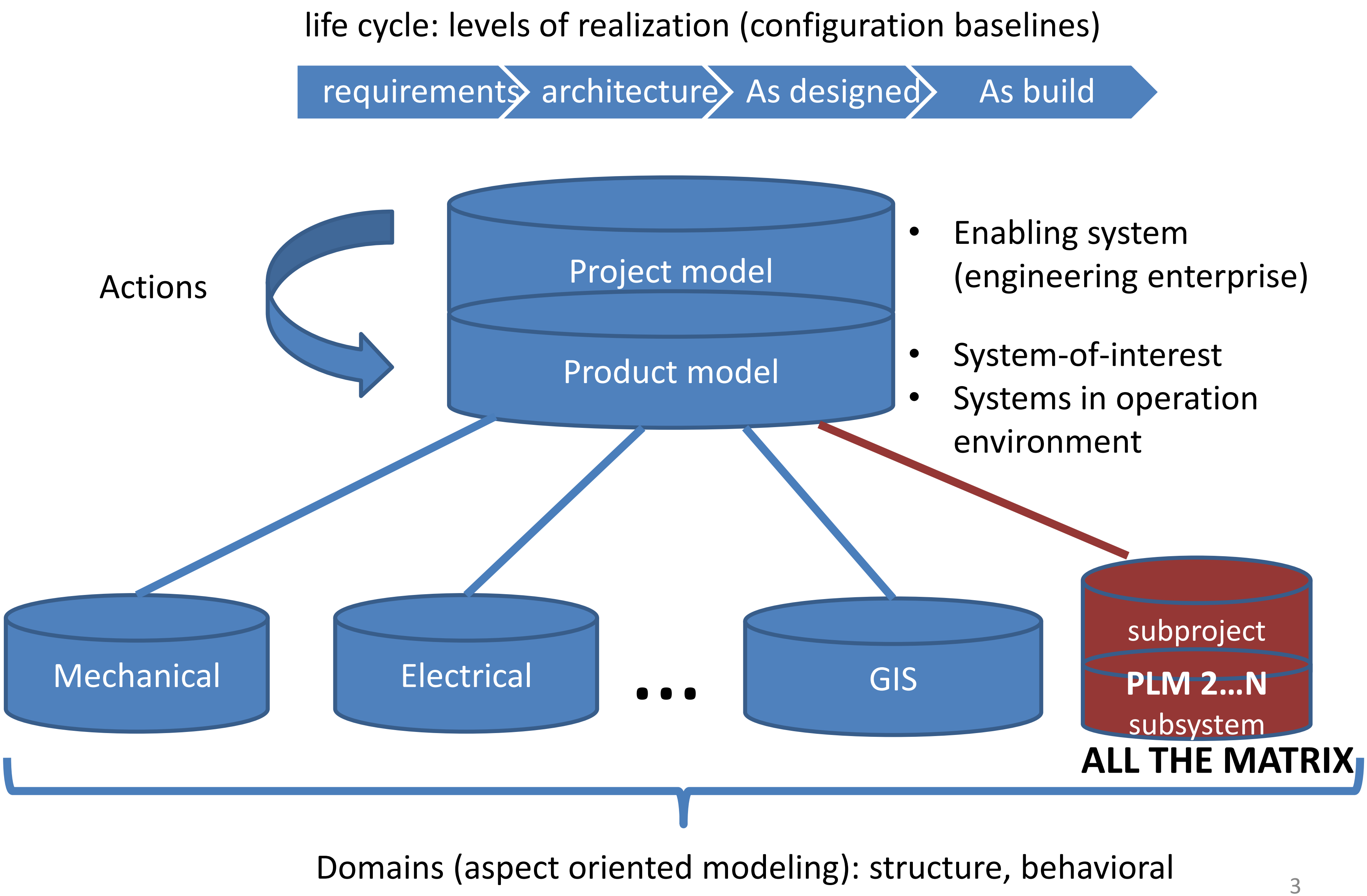
Levels of matter * levels of realization

- Engineering specialties/professions/domains: multiple in every cell – systems engineering needed
- Integration in a end product: all the table

	Requirements	Architecture	Design	Implementation	Operation
Macro (plant)					
Meso (pipline network)					
Micro (pipe)					
Nano (steel)					

Contemporary PLM architecture



Problems in definition of ontology for system-of-interest and system in operation environment (PLM "repository", product model)

- ontology of system components and modularity (system with subsystems, interfaces, catalogs)
- Geometry (shapes and mereotopology)
- UoMs
- Causality, mapping, "meta", requirements, etc.
- trace relations, deontic modalities
- Configuration baselines, design/solution variants (modalities as possible worlds)
- risk modeling and assurance case
- Socio-technical systems representation (enterprise engineering, see next slide about ogranization modeling)
- Real-time behavioral modeling (multi-physics). Example: Simantics software platform: not too similar to ordinary PLM in ontology part but very similar in data integration architecture
- Multiparadigm Software and computers (cyber-physical systems)
- … (multiple other domains of contemporary engineering)

Problems in definition of ontology for enabling system (PLM workflow/issue tracking, “project model”)

- situational method engineering (SME): systems engineering as a specific method of work (BoK)
- System life cycle models, adaptive case and issue management, process and project management, organograms: enterprise architecture. Processes defined at design time and at run-time.
- Motivational models for human action in enabling systems/systems of systems/extended organizations/eco-systems (praxeology)

Syntactic problems (languages and expressivenes)

- Object with attributes (“what an object in one project is an attribute in another”), not fact-oriented
- OWL is considered harmful.
- Architecture language (systems engineering ontology-based language) needed. SysML is considered harmful.

Ontology evolution

- Multiple enabling systems → multiple PLM, multiple ontologies.
- complex engineering project lasts 10 years and more. Ontologies of all authoring tools and PLM will be changed during project.
- Contemporary reference data will be legacy reference data. Needs international standardization for representation, record keeping and maintenance.
- We need inherit and adopt/re-engineer reference data (ontology) from legacy systems as a first step in evolution

What to do with distributed reference data configuration management while witnessing of massively parallel evolution of ontological «eternal classes»?

Legacy standards, regulations, prototypes

Legacy standards, regulation and prototype designs and projects are mix of natural language sentences, semiformal and formal (often graphic) languages.

We need new type of NLP parsers: *engineering language* (diagrams, drawings, texts with tables and formulae) *processing.*

This needs combined usage of terminology/semiotics and ontology.

Education

- We have bad experience of work with IT people and engineers: they expect 3 day courses should fit for ontology-based data integration.
- How to teach people for ontology-based data modeling in 3 days? (not tell me that this is impossible!)

Questions?

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