

International Workshop on Software Engineering for Smart Cyber-Physical Systems (SEsCPS)

Versioning in Cyber-Physical Production System Engineering – Best-Practice and Research Agenda

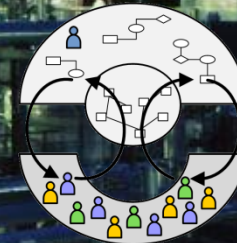
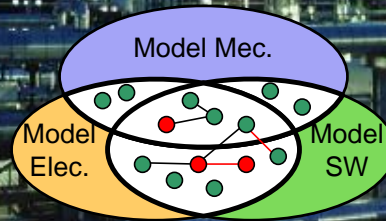
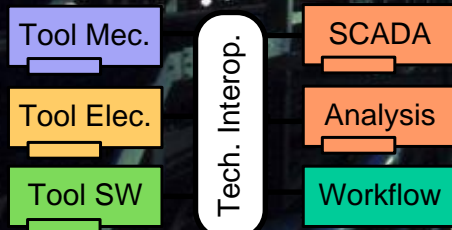
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Motivation & Background



Motivation:

- Large-Scale Engineering Projects, e.g., hydro power plants, car manufacturing plants, steel mills.
- Cooperation of different engineering disciplines.
- Disciplines have specific engineering tools.
- Manual effort required for data exchange and synchronization (high risks).

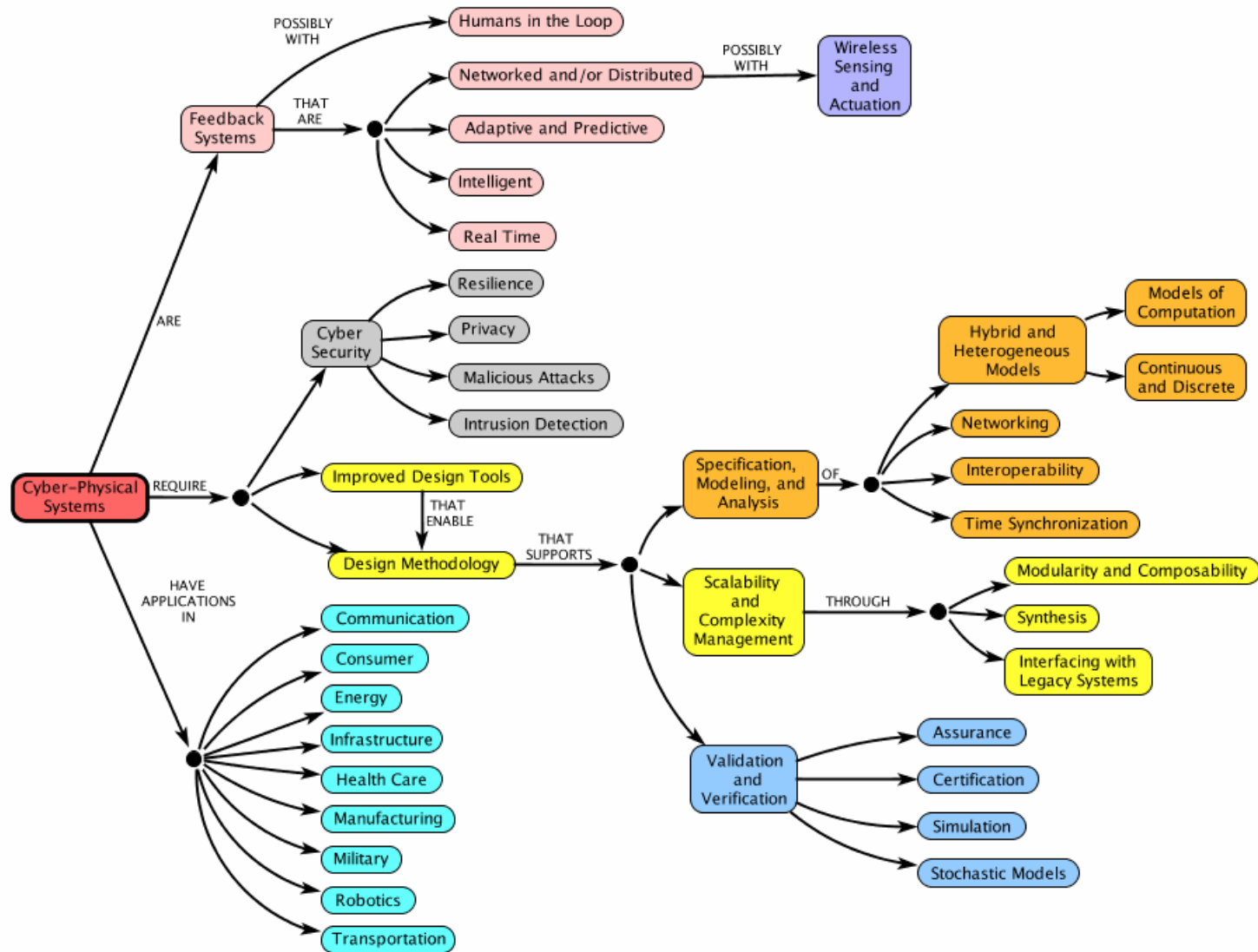


Key **research questions** focus on:

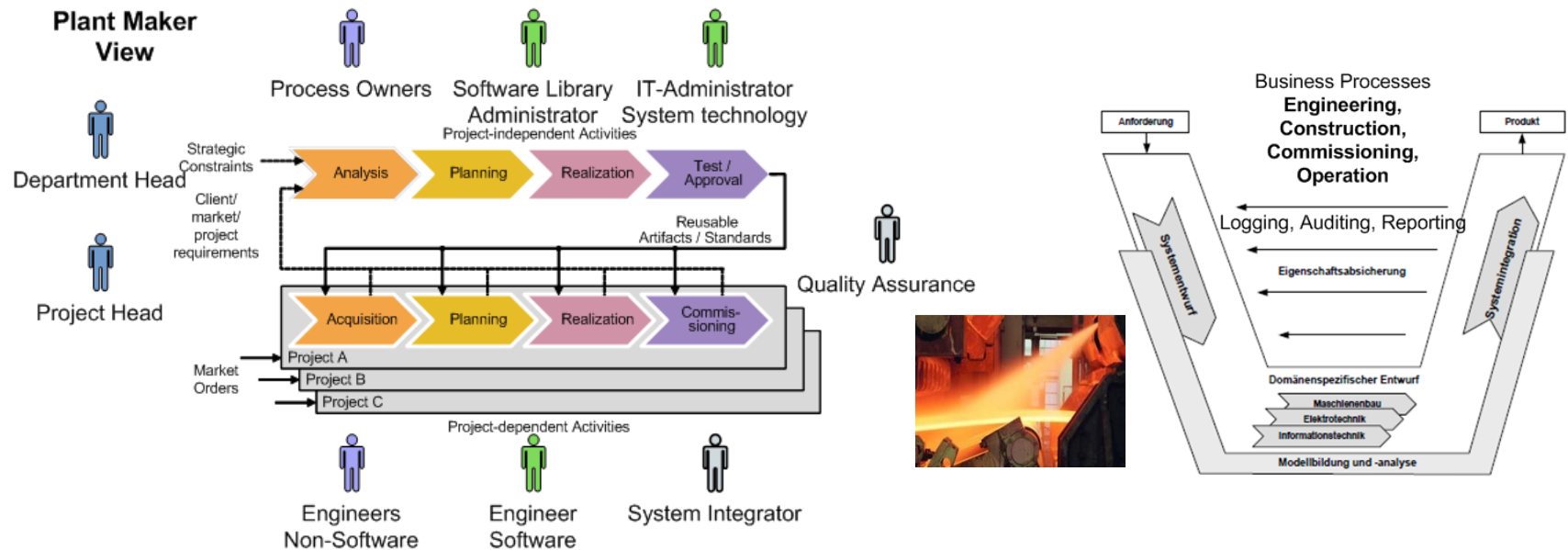
- domain experts and researchers in ASE environments
- with a set of concepts, methods, and tools
- to make informed decisions on top of integrating engineering knowledge
- to design advanced applications for mitigating risks of defects in the engineering of flexible automation systems



Position of Research in CPS Concept Map



Characteristics of Automation Systems Engineering



Limited engineering process analysis and improvement capabilities

- Engineering processes seem sequential but have loops back.
- Heterogeneous knowledge representations in diverse engineering models.
- Fragile change management in parallel multi-disciplinary engineering.
- Insufficient early risk management in a heterogeneous environment.

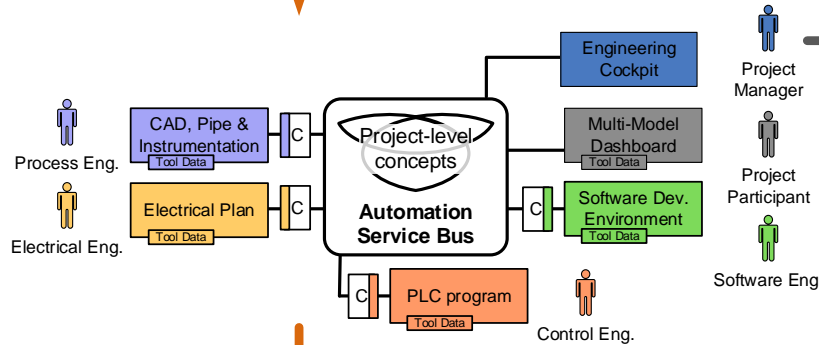
Industry 4.0: Engineering Knowledge at Run Time



Engineering Phase

Business Requirements

Integrate Business Requirements in Engineering

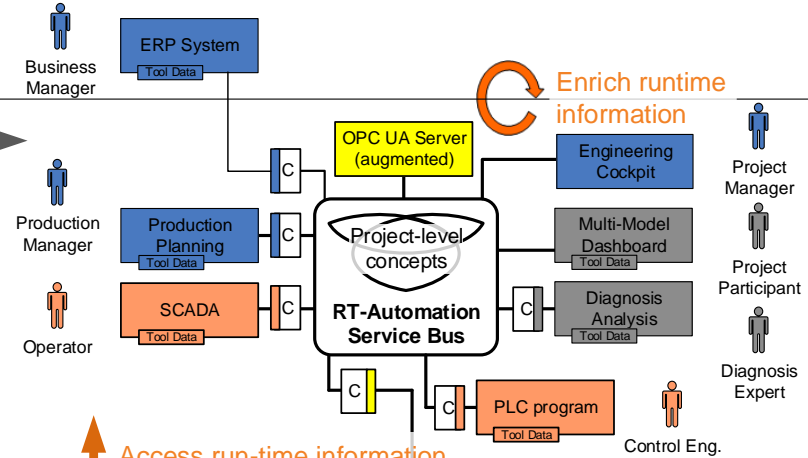


Deploy created artifacts

Cyber Physical Production System (CPPS)



Test/Operation Phase



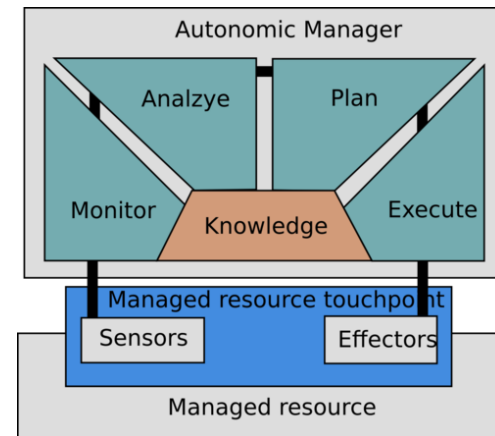
Access run-time information

Access engineering information

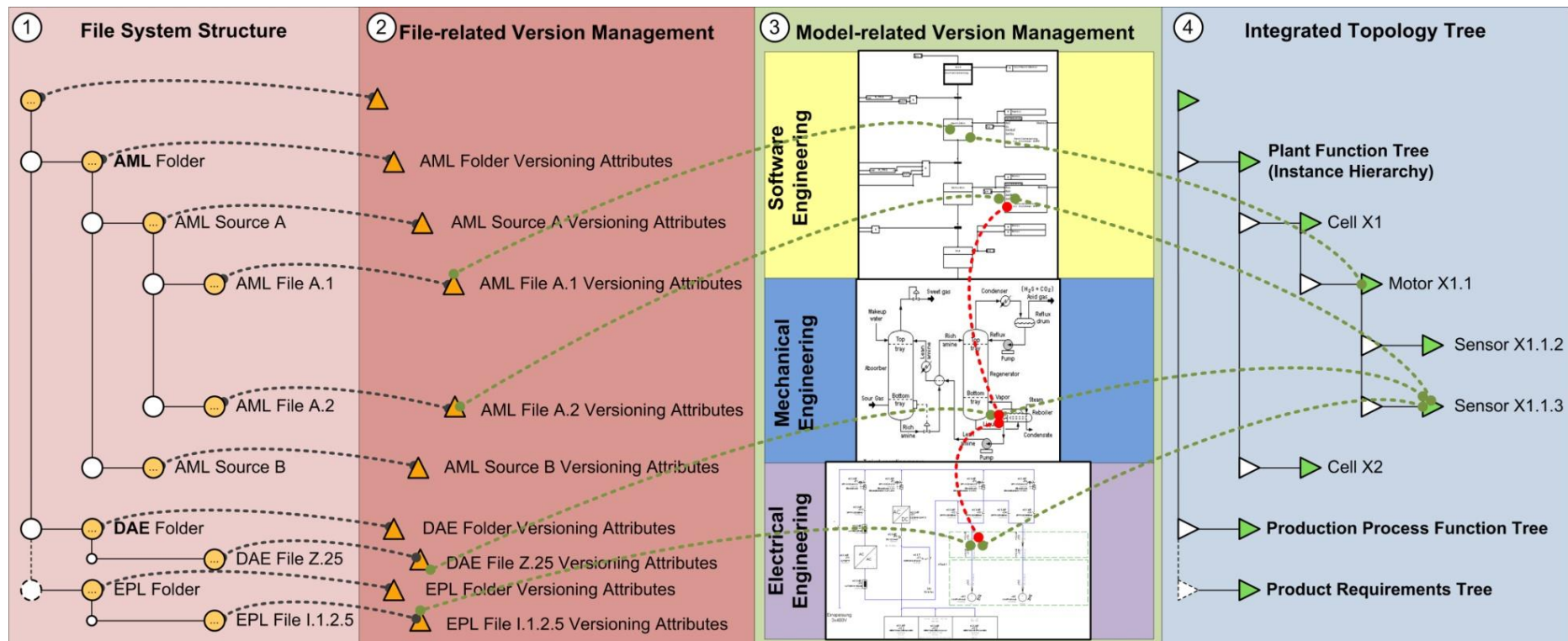
Cyber Physical Production System (CPPS)



- Flexibility increases system complexity
- Need for better integrated engineering to cope with larger solution space and with system changes at run time
 - commissioning



Version Management of Mechatronic Objects



- Versioning of various semantic model element levels
 - File, Folders, Structural Elements, and detailed content levels
- File-Level Versioning not sufficient
 - reflects data format syntax
- Detection of Changes at Model-level

Summary & Research Aspects



- Engineering of sCPS needs to cope with multiple heterogeneous engineering domains

- Data heterogeneity integration
 - Methods, tools and modeling approaches of various domains
 - Access to domain specific model data from project/process level

- Versioning and linking of engineering artifacts
 - Scalability of framework in managing versions
 - Formulation of cross-domain queries with domain-specific knowledge

- Model-driven engineering
 - Modeling permitted changes of the production system during runtime
 - Modeling corridor of allowed changes
 - Formalization of operator's knowledge to support automation