SOMM: Industry Oriented Model Management Tool

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Smart Factories

fully computerised, software-driven, automation of (production) processes and enterprise-wide integration of software components

Information models
- critical in enabling smart factories
- machine-readable conceptualisations / specifications
- describe assets: equipment & production processes in a plant
- address complexity of software dev. and integration process
  - raise the abstraction level
  - capture: functionality of & info flow between components

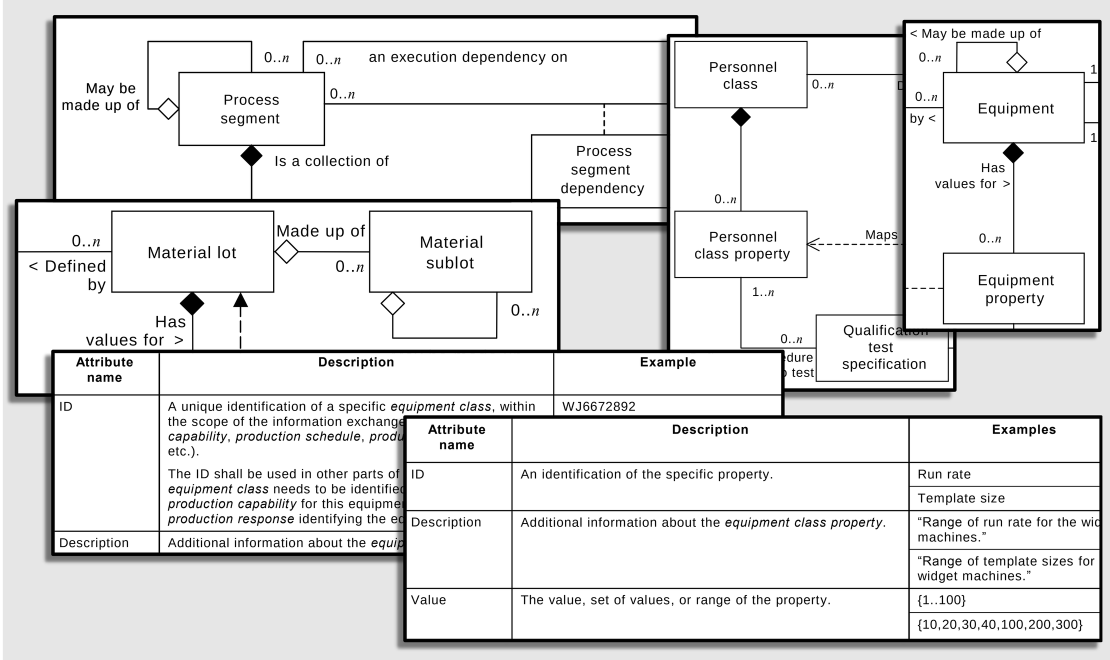
Information Models in Siemens

Many different types of models co-exist
- independently developed
- different (often incompatible) formats
- developed using different types of proprietary software
- models may not come with a well-defined semantics
- specifications of models can be ambiguous

Challenges in practice
- model development, maintenance, and integration
- data exchange and sharing

Manufacturing Model

ISA 88/95

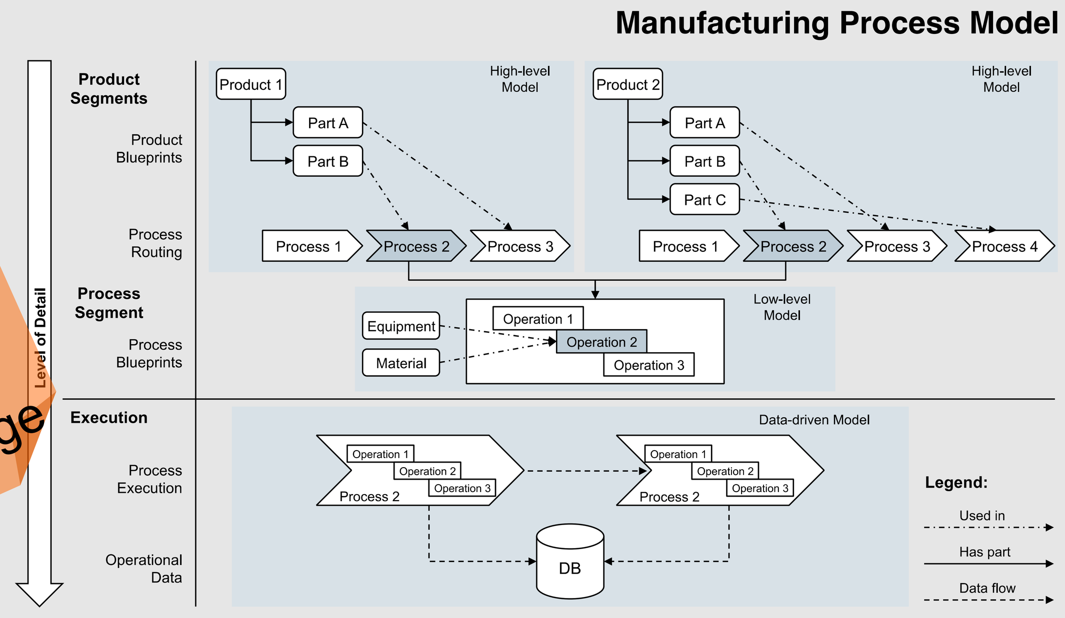


ISA 88/95
1. General guidelines for specifying
   - functionality of
   - Interface between
   - manufacturing software
2. Consists of
   - UML-like diagrams
   - Tables, text
   - Examples

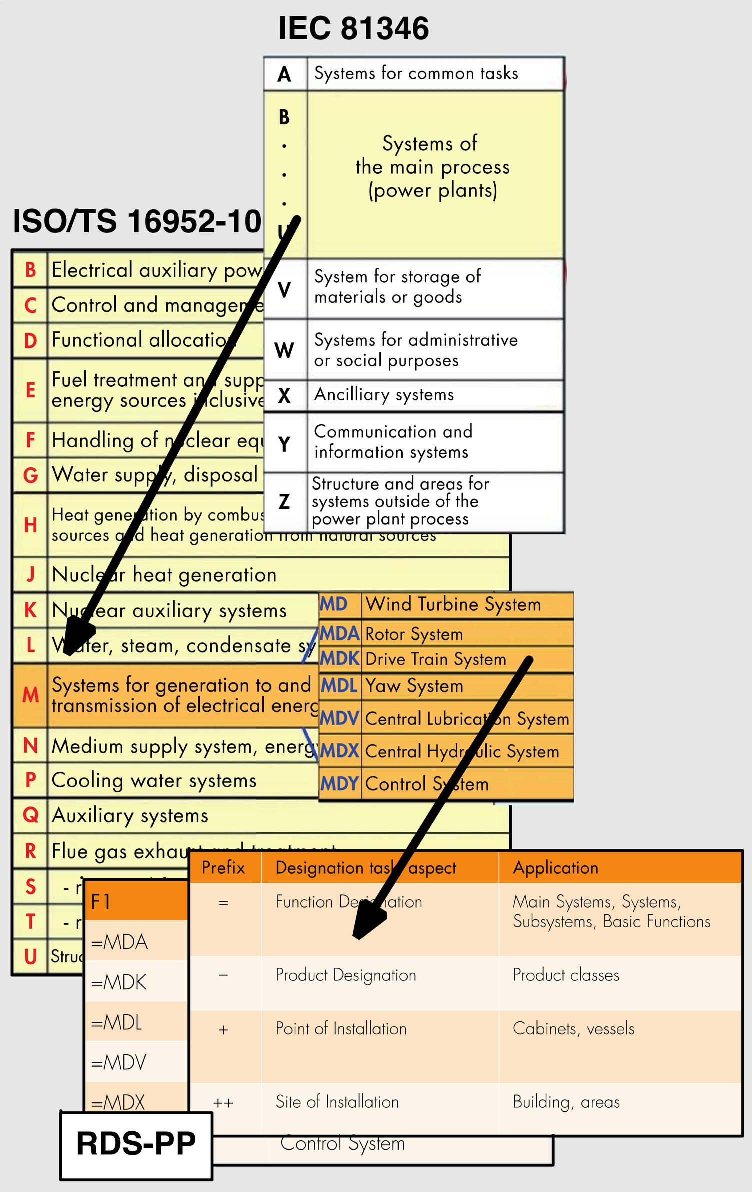
ISA 88/95 based manufacturing model
- Design & production
- Three layers

Role of Info. Models
- Schema: construction & execution of complex Qs
  - monitoring tasks
  - anomaly detection
- Data: exchange, storage

Manufacturing Process Model

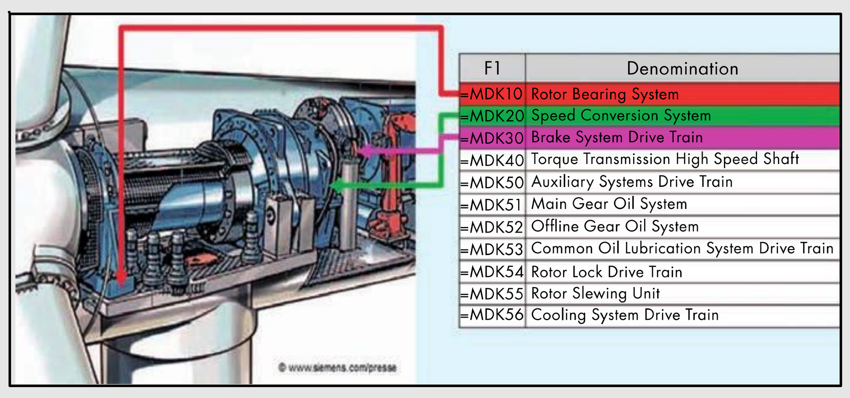


Energy Production Model



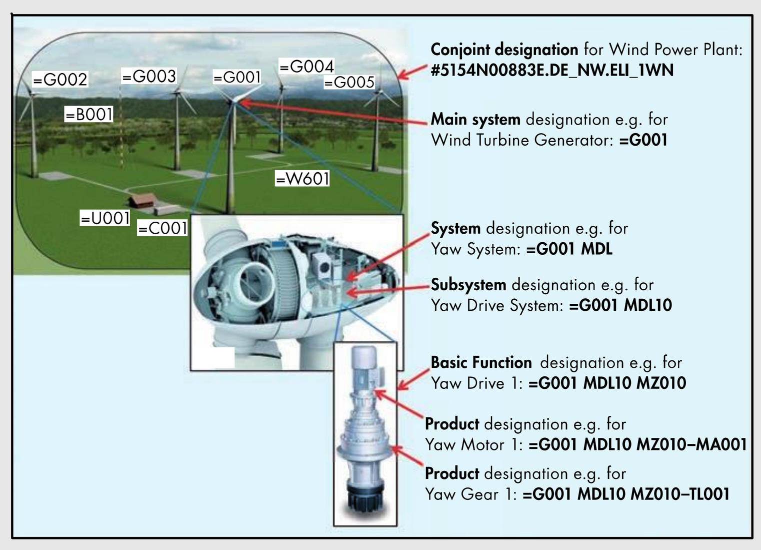
Standards
1. EC 81346, ISO/TS 16952-10
   - generic dictionary of codes
   - designation & classification of industrial equipment
2. RDS PP and KKS
   - extra codes for energy equipment
   - functionality, locations
   - system for combining codes

Plant Model based on standards
- describes the structure of a plant
- by providing functionality & location of each equipment component
- using RDS PP and KKS codes.



Wind Turbine Model

Wind Power Plan Model



Semantic Models for Siemens

OWL 2 for information models
- rich, unambiguous, standardised & flexible modelling language
- well-suited for describing industrial information models
- a wide range of tools for, validation, integration, and reasoning
  → automation of labor-intensive, error-prone tasks

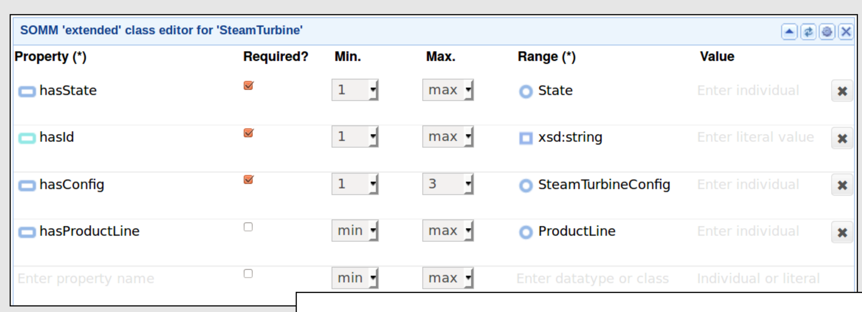
RDF for data exchange
- unified data format for access and exchanged
- RDF triple stores for storing, highly scalable query answering
- can be effectively queried in conjunction with ontologies

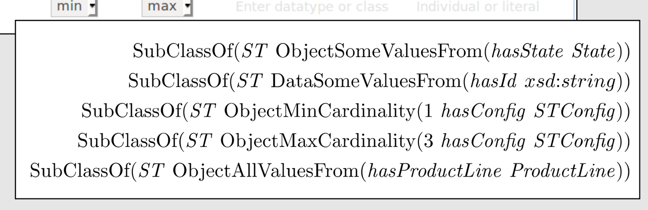
Ontologies in Siemens
- Have been successfully used for
  - Ontology Based Data Access
  - MES and shop-floor level diagnostics
- Developed by R&D personnel familiar with SW technologies

Project Goals:
- to widen the scope of ontologies in Siemens
- to scale onto development
- to provide industry-oriented ontology management tool

SOMM: Siemens-Oxford Model Manager

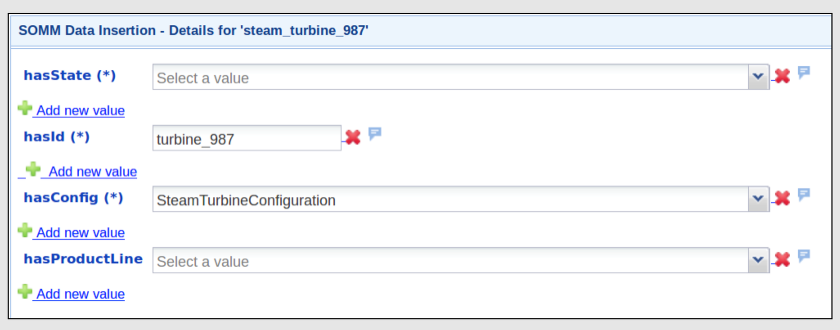
Axioms & constraints (A&C)
1. Form based interface
2. A&C on the same interface
3. A&C encoded in Datalog



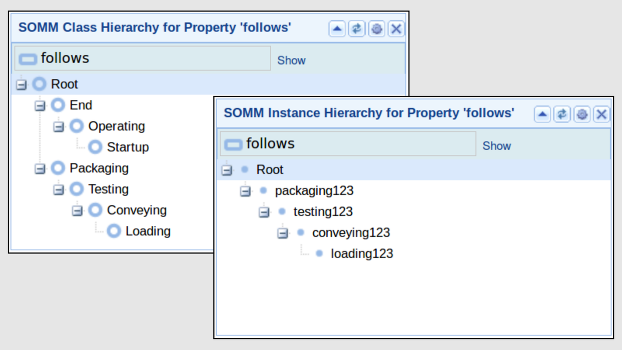


Auto-generated data forms
1. From properties assigned to classes
2. Both explicit and implicit

Extended hierarchies
1. Based on arbitrary properties
2. Generalisation of partonomies



Alignment
1. Allows to merge and import models
2. Based on LogMap



Reasoning
1. Schema and Instance level reasoning
2. Hermit for schema level reasoning
   - Ontology classification
   - Class satisfiability
3. Datalog engine with Stratified Negation
   - Data validation
   - Query answering