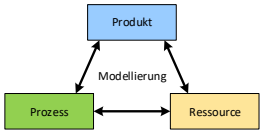
Improving engineering processes with PPR modeling



Product, production process and production resource (PPR) modeling allows an iterative work process where basic planners can create initial product assemblies with related processes and resources. Ranging from initial drafts to more detailed and complex models, PPR modeling is a flexible concept, which allows a structured knowledge transfer from basic engineering to detailed planning, engineering, commissioning, and operation.

Goal

In production systems engineering, different roles are present and form a multi-disciplinary engineering environment (see Figure 2). A common challenge hereby is, that different stakeholders prioritize the product, production process, or the production resource differently, which may lead to an information-bottleneck and an insufficient explicit PPR knowledge representation.

Main goal is to improve the engineering process and avoid the loss of product and process specific knowledge and also to provide a common view regarding PPR.

Implementation

In context of an engineering process improvement initiative and to be able to fully harness the potential of PPR in an engineering life cycle, four different steps support the generation of an efficient and effective PPR modelling approach.

1) Data Processing Map creation

Before being able to model the PPR concept and include it in a planner's day to day work, an analysis of the as-is state needs to be surveyed. This survey yields a data map, including process steps, process tasks, stakeholders as well as input and output artifacts.

2) Requirements Analysis

Identified artifacts and their content can be mapped and classified according to the PPR principle. Based on this classification, requirements are extracted and weighted for modeling language selection.

3) Modeling Language Selection

Requirements derived from step 2 serve for the benchmarking of existing modeling languages. The language suiting best for further modeling is then selected.

4) Modeling of PPR Knowledge

After benchmarking available modelling languages, adaptations to the selected modeling language can be made. Figure 1a depicts a basic high-level model for PPR based on VDI 3682. The process transforms two input parts into one output part. The depicted process is a meta-process; figure 1b shows the detailed PPR model. PPR allows the modeling of resources with similar concept as presented for processes. This allows an iterative workflow and adapting the level of detail for each model as required.

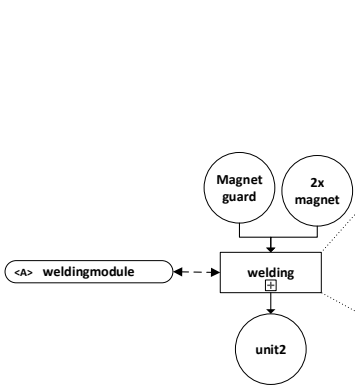


Figure 1a: High-Level metaprocess PPR model

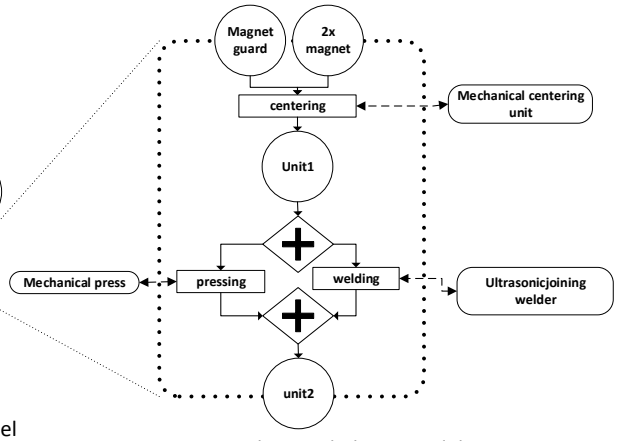


Figure 1b: Detailed PPR model.

Illustrative Use Case

Figure 2 shows a candidate baseline for starting the PPR modeling process.

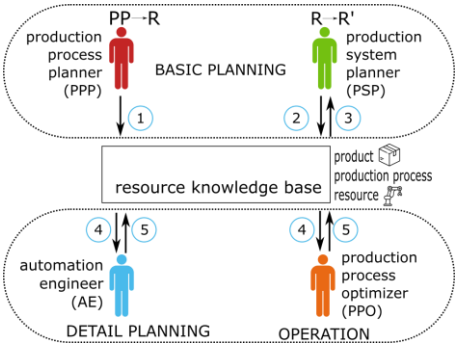


Figure 2: Multi-Disciplinary Engineering Process – AS-IS.

1. *Production Process Planners (PPP)* get information from the customer and stores an initial resource layout.
2. *Production System Planners (PSP)* receive resource information and create basic variants of the resource.
3. *PSP* store selected resource variant in the resource knowledge base.
4. *Automation Engineers (AE)* and *Production Process Optimizers (PPO)* receive resource knowledge and try to enrich this knowledge.
5. *AE* and *PPO* store additional details about the resource.

The transitions from step one to two and step three to four loses vital product and process information. This is because there only exists a resource knowledge base where no PP knowledge can be stored.

The PPR modeling aims at improving unstructured information transformation, by providing a concept to explicitly represent PPR knowledge and transfer this knowledge throughout an engineering process. Furthermore this approach also enables further customizations in the terms of supporting data formats like *AutomationML*.

Technical Specification

- Iterative process supporting the modeling of detailed PPR assemblies.
- Flexible use of modeling concepts and potential custom extension.
- Open choice of data storage models, such as different database types.

Benefits for Customers

- Structured improvement process for introducing PPR.
- Risk assessment with focus on possible losses of PPR engineering knowledge.
- Modeling concept supporting different engineering phases and requirements.

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