Layered-V

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Background

The development of safety-critical, embedded systems often fails in terms of time limits and cost constraints. A commonly occurring reason is the vast amount of standards, guidelines and other mandatory defaults, which have to be considered for each artifact produced within the origination process. This outgrowth of additional commitments entails serious consequences, which are vividly depicted by the "Grey Report" ([1]) in 2009 and a similar report ([2]) in 2014. [1] tells of mean additional costs of 40% and temporal delays of 80% of projects within the British Armed Forces. [2] identifies the same problems as [1] and tells of single projects, whose temporal delay and cost increase amount to 200% of the originally planned values.
Based on both reports, we identified 7 challenges which must be tackled in order to meet with the current grievance

Challenges

1. Integration and targeted preparation of heterogeneous data of different business divisions
2. Impartial comparability of standards, guidelines and other mandatory defaults
3. Tailoring of complex processes an subsequent negotiation with customers and/or authorities in an early stage of the development
4. Increased risk management and improved assessment of projects in their early stages
5. Enhanced product line engineering – better and easier reusability and integration of existing (sub)systems
6. Consistent and transparent reporting structures for various roles and responsibilities
7. More strict requirements- and change management processes guided by a superior strategy

Solution
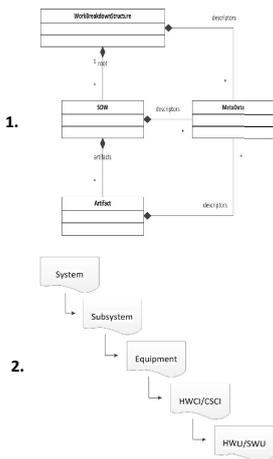
1. Data model:
- Based on MIL-STD-881
- One WBS per Project
- A SOW contains all work to be performed for a specific item
- SOWs can have artifacts
- Artifacts and SOWs can have MetaData

2. SOW-Hierarchy:
- Based on MIL-STD-498
- SOWs can be structured hierarchically
- 5 hierarchy levels are predefined
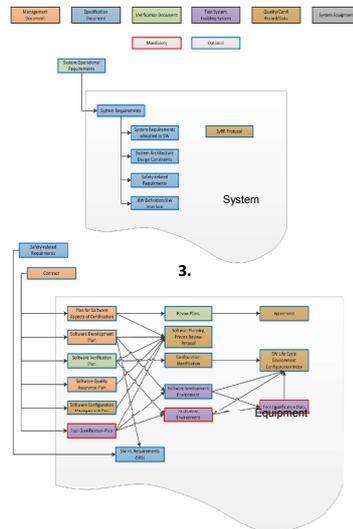
3. Templates:
- For each standard, guideline, process to formalize, 5 Template SOWs are created (one per hierarchy level)
- Each SOW defines all its mandatory/optional Artifacts

4. Project-specific System Breakdown
- For each project a System Breakdown is created, reflecting the hierarchical structure of the system under development
- Each SOW in the System Breakdown gets assigned one of the 5 predefined hierarchy levels
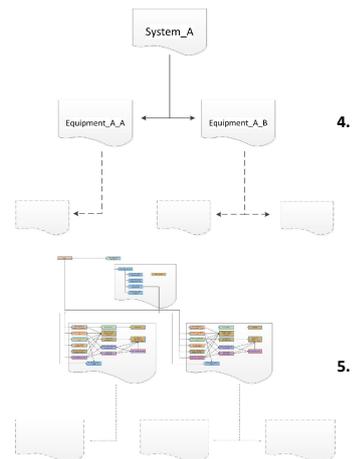
6. Starting, monitoring and controlling of a project
- 6 views on the data model are predefined (Process, Project Management, Costs, Function , Qualification, System)
- The majority of stakeholder can be assigned to one or several of these views
- Each view utilizes a predefined set of MetaData to show its own interpretation of the underlying data model
- The six views enable various stakeholder to achieve a holistic understanding of the system under development
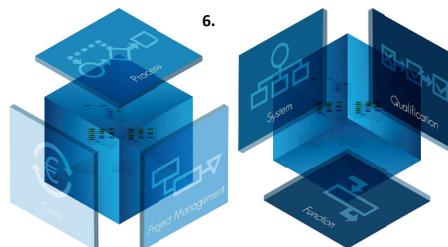
5. Combination of Templates and project-specific System Breakdown
- Templates are chosen according to the demanded standards, guidelines and other mandatory defaults, the project has to be compliant to
- Each SOW in the System Breakdown receives all Artifacts defined in the SOW of the same hierarchy level of the chosen Template

Added Value

- Challenge 1: Our data model provides consistent data across various business divisions and the 6 views offer a targeted preparation of this data
- Challenge 2: The created templates make standards, guidelines and other mandatory defaults comparable and eventually combinable
- Challenge 3: Tailoring is made easy, as each instantiated project (see 5.) contains all needed artifacts from the beginning and can be adopted afterwards by removing those artifacts that are not needed
- Challenge 4: By tool support for our methodology we achieve a rapid project setup with all needed standards, guidelines, processes, etc. and therefore are able to estimate the scale of the project in an early stage. This aids us in reducing potential risks and the early estimation helps at subsequent negotiations with customers and/or authorities
- Challenge 5 - 7: Subject of further research

[1] B. Grey, *Review of Acquisition for the Secretary of State for Defence*, 2009
[2] T.W. KPMG P3 Group, *Umfassende Bestandsaufnahme und Risikoanalyse zentraler Rüstungsprojekte, Exzerpt*, 2014

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