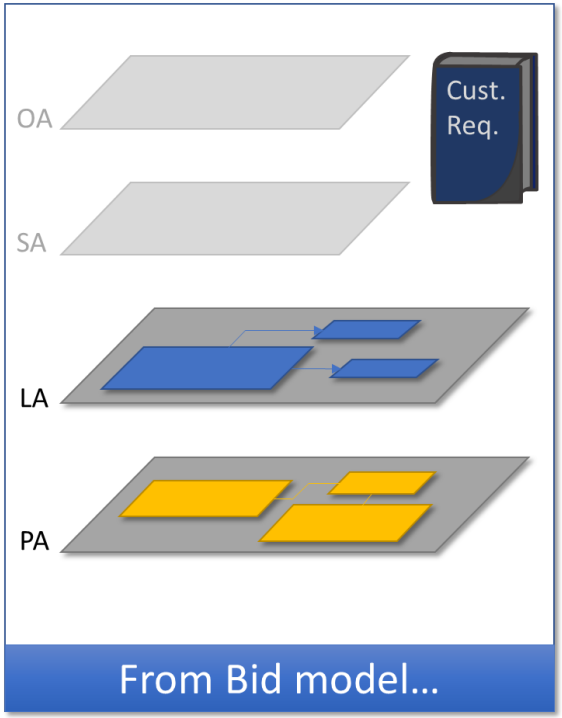
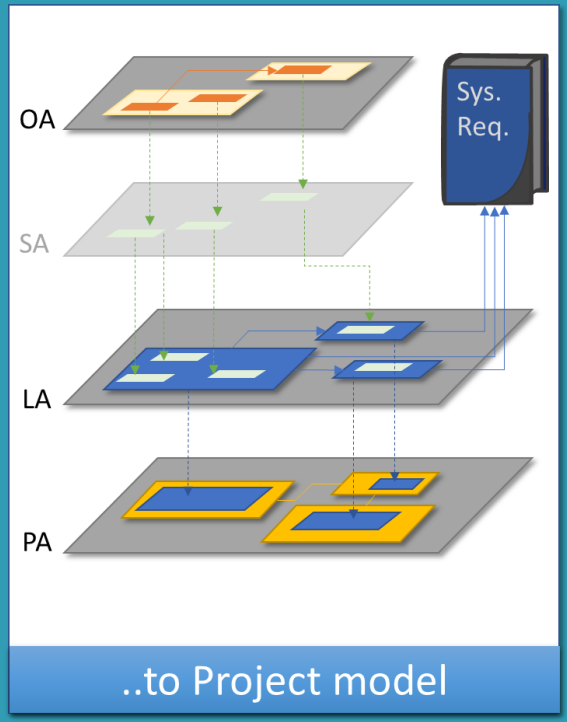
The long way …



From Bid model…

Supported by Capella™



..to Project model

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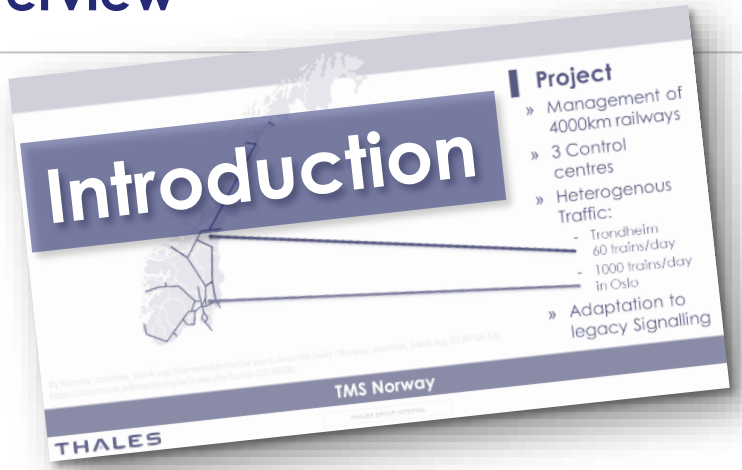
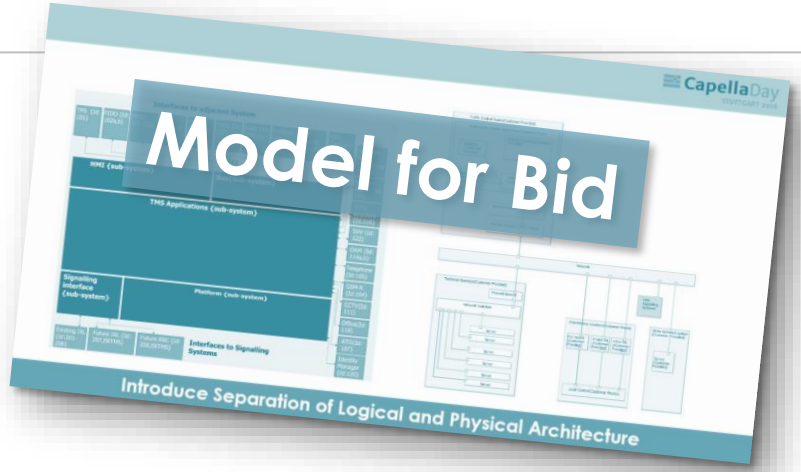
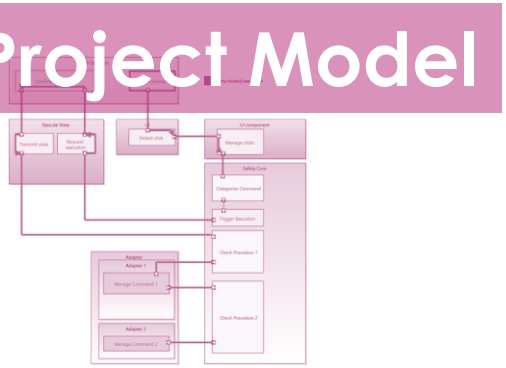
Overview







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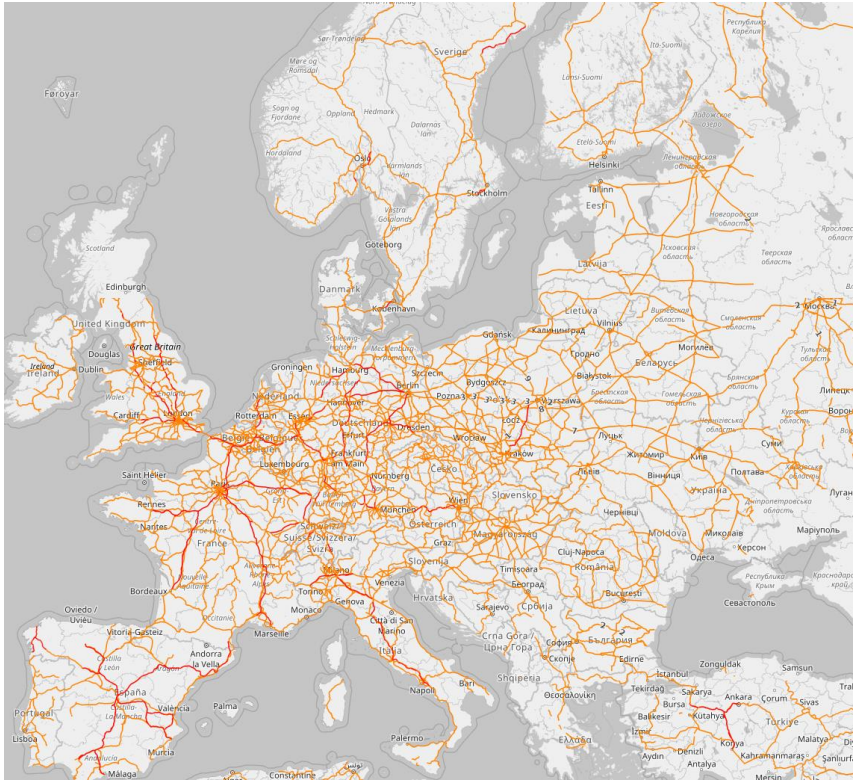
Introduction

Railway Traffic Management System TMS

Bid/Project TMS - Norway

Introduction – What is a TMS?

Picture of Andrew Jenner on Pixabay

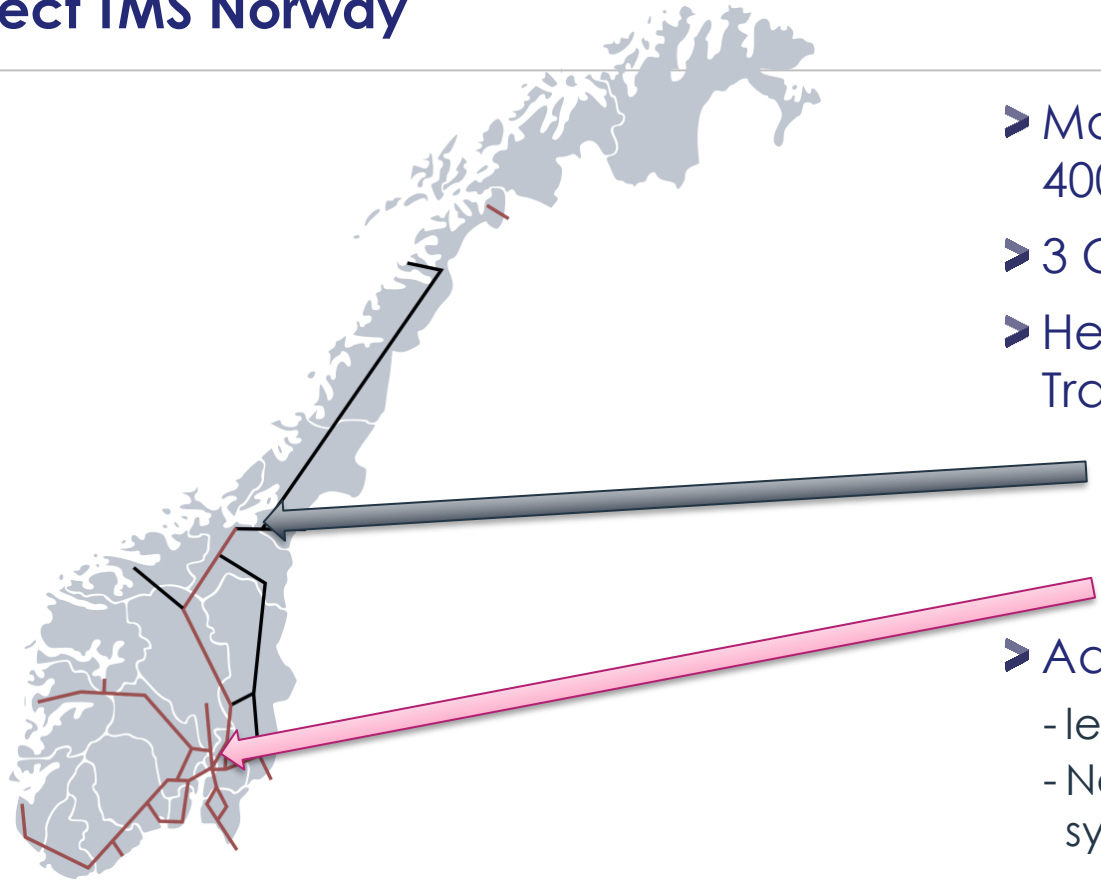


Traffic Management Systems provide:

globally optimized Railway Traffic

local operation of Signalling systems

Project TMS Norway



- Management of 4000km railways
- 3 Control centres
- Heterogenous Traffic:
  - Trondheim 60 trains/day
  - 1000 trains/day in Oslo
- Adaptation to
  - legacy Signalling
  - New European ERTMS/ETCS systems

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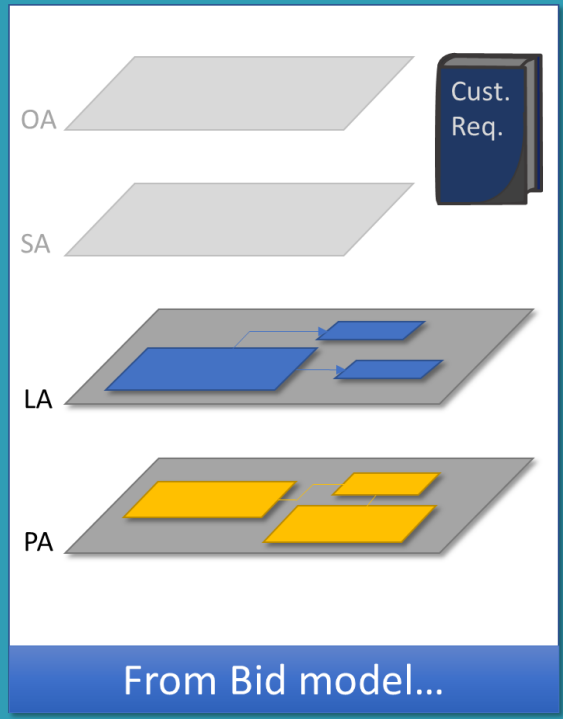
CapellaDay
STUTTGART 2018

Model for Bid

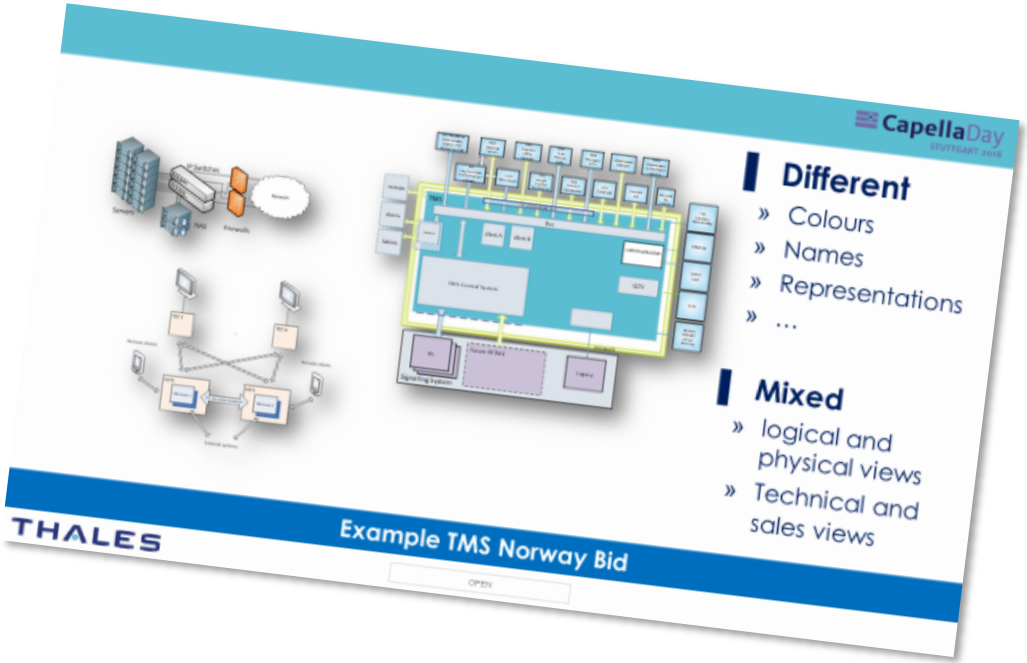
Problems in Bids

Capella for modelling the architecture



Problems in Bids

- Different „Languages“ and tools
- Misunderstandigs
- Poor presentation in documents



Bid model

Usage of logical and Physical Architecture

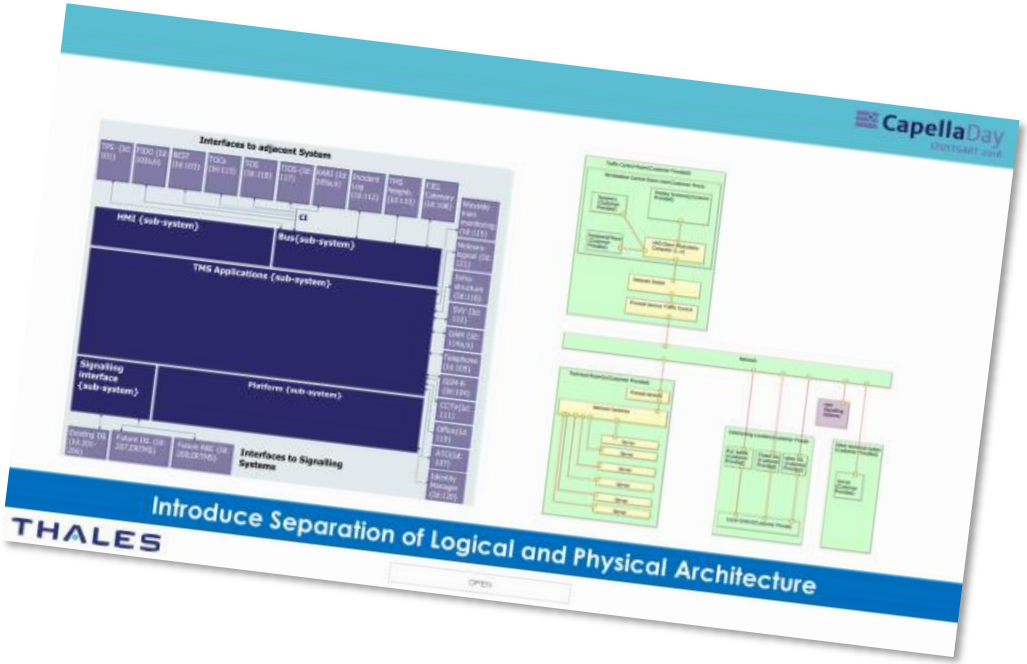
- To separate views
  - to avoid misunderstandings
  - Identify missing topics
- To have a common view on the system

(partial) functional allocation

- Identify critical scenarios
- Helps in customer discussions

Challenges

- Introduction effort
- “new tool”…



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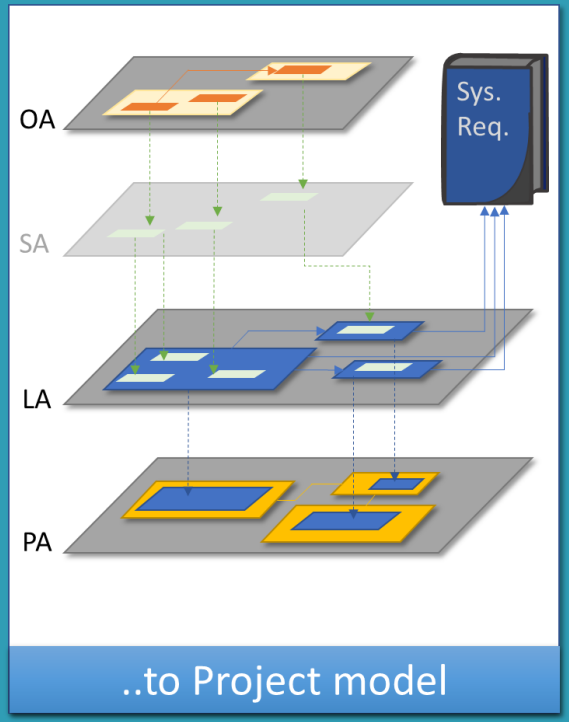
Model for the Project

…we won the bid, and now?

How to proceed with the bid model?
How to describe technical/operational scenarios?
How to introduce safety aspects?
Challenges



How to proceed with the Bid model?

Reused on physical architecture level ✓

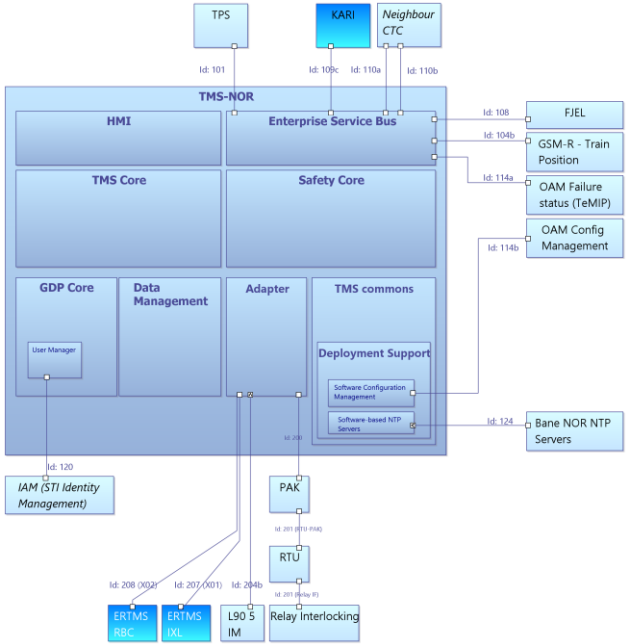
Reimplemented logical architecture level ✘

- Structure of bid model does not fit 100% to software structure
- Much more refinement necessary to help software architects

Added more functions and functional chains ✓

- On logical architecture
- To extend critical scenarios (e.g. safety)

Connect Requirements to model (loose coupling) ?



How to describe technical/operational scenarios (TOPSCs)?

Requirement of Customer

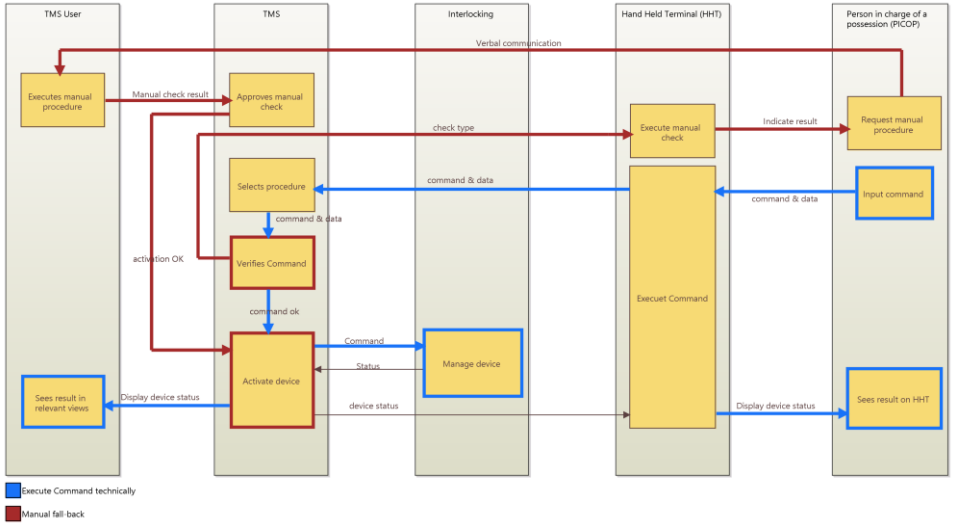
- „Describe how you implement technically our defined Operational scenarios“

Decision

- Use Capella Model for this purpose
- Use Operational Analysis, not System Analysis

Creation

- Guideline for modelling
- Work in parallel with up to 10 people using Teams for Capella



Customer approves Modelling tool usage

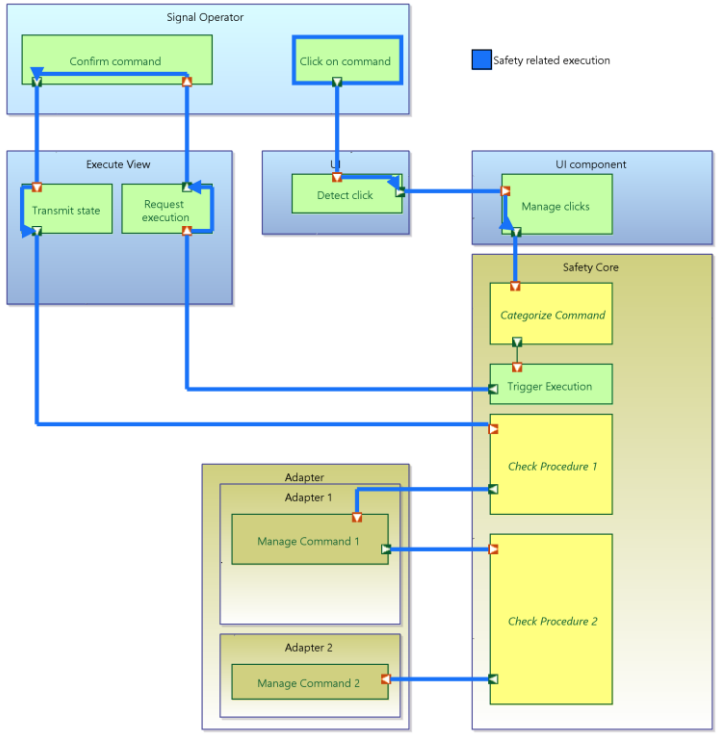
How to introduce safety aspects?

Safety requires detailed dynamic description

- Used Logical Architecture Diagrams
  - With functions
  - With functional chains
  - For regular/principle flow
- Used sequence diagrams
  - To detail sequences
  - To show failure scenarios

Diagrams helped in discussion

- With customer
- With Software architects
- With Safety Engineers



Challenges

Install modelling rules for more than ten people working in one project

Stepwise approach for culture change needed for

- Document/requirements based to model based system engineering

Transition to software engineering

- (Slightly) different languages (UML…)
- Different approach (e.g. objects and instances)
- Different tools…

Picture of PixxlTeufel on Pixabay

Result, Questions

Result:

- **Applicable approach for MBSE**
- **Extensible Architecture**
- **Experienced Architects**