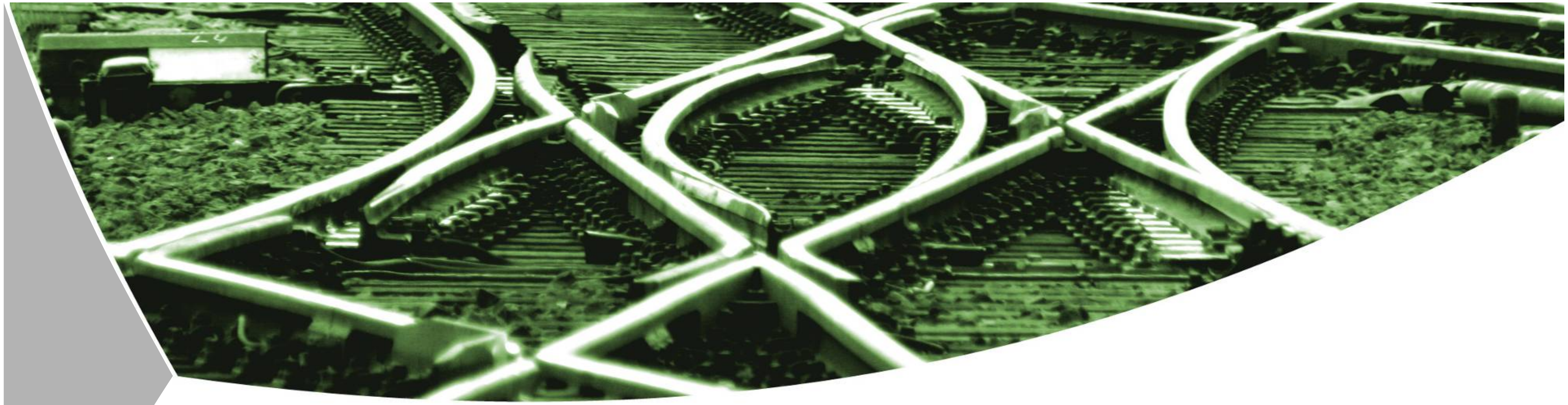

Tool-based Safety Analysis of Operational Rules

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Overview

- Background
- Challenge
- Approach
- Method for Analysis
- Example – Telephone Block Operation
- Findings of the Example
- Conclusions

Background

- Complex systems integrated for the operation of railways
- Complex operational rules used
- Systems consist of various sub-systems, some of them are safety-related
- High safety requirements for railways
  - ⇨ High-quality components required
  - ⇨ High life cycle costs
- New systems often based on structures of existing systems
- Existing systems get modified (to fit new requirements, to be employed in different environment)
- Modifications in complex systems cause high effort for the reassessment of the system‘s safety / assessment of the consequences to safety

Challenge

Reduction of LCC

e.g. for acquisition, operation, maintenance, ...

Increase of Safety

e.g. increase of reliability, decrease of forces

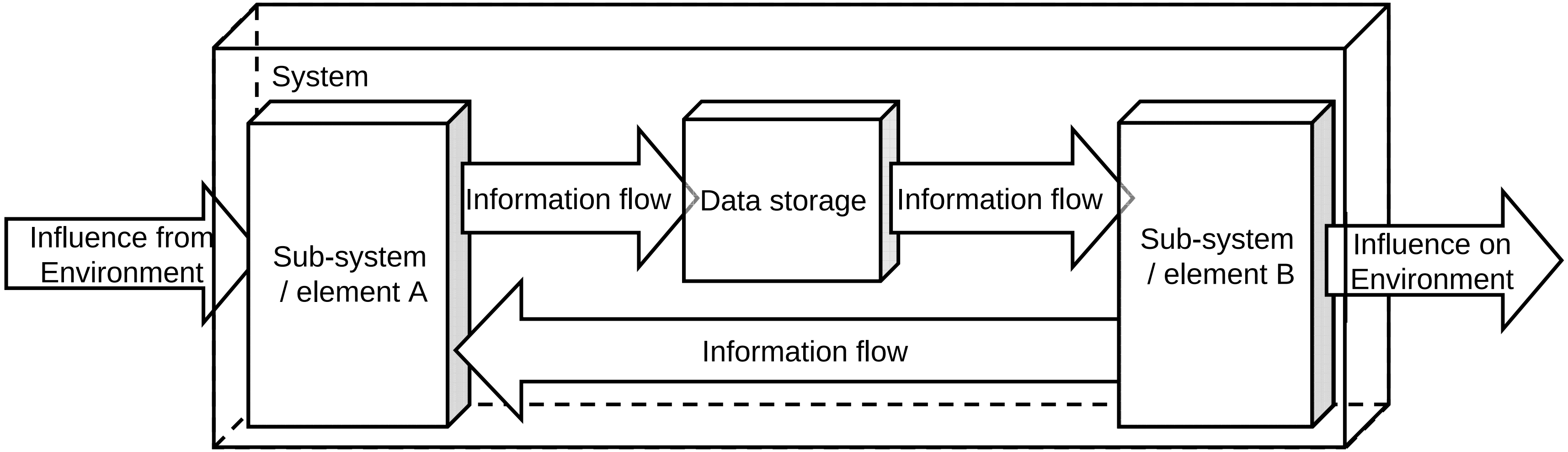
By means of

- Utilization of most suitable components (low-cost ⇔ highly reliable)
- Implementation of safety functions
- Use of safe rules for operation

⇨ Analysis needed to show the possibilities for optimization

Approach

- Assessment of all elements and communication flows between the elements of the system



- Computer-supported system analysis for design* and rules

* here: control technology, not structure / material

Method and Tool for Analysis

Method

- Assessment of interactions with system environment
- Allocation of acceptable risk or similar
- Assessment of each sub-system generating interactions with environment
- Assessment of information influencing the interactions
- Assessment of sub-systems generating the information
- Assessment of sensors generating the information

The requirements on the output influence the requirements on the input!

SW Tool SALT

- Automatic allocation of safety relevance to each element (sub-system, information, sensors, ...)

Method and Tool for Analysis

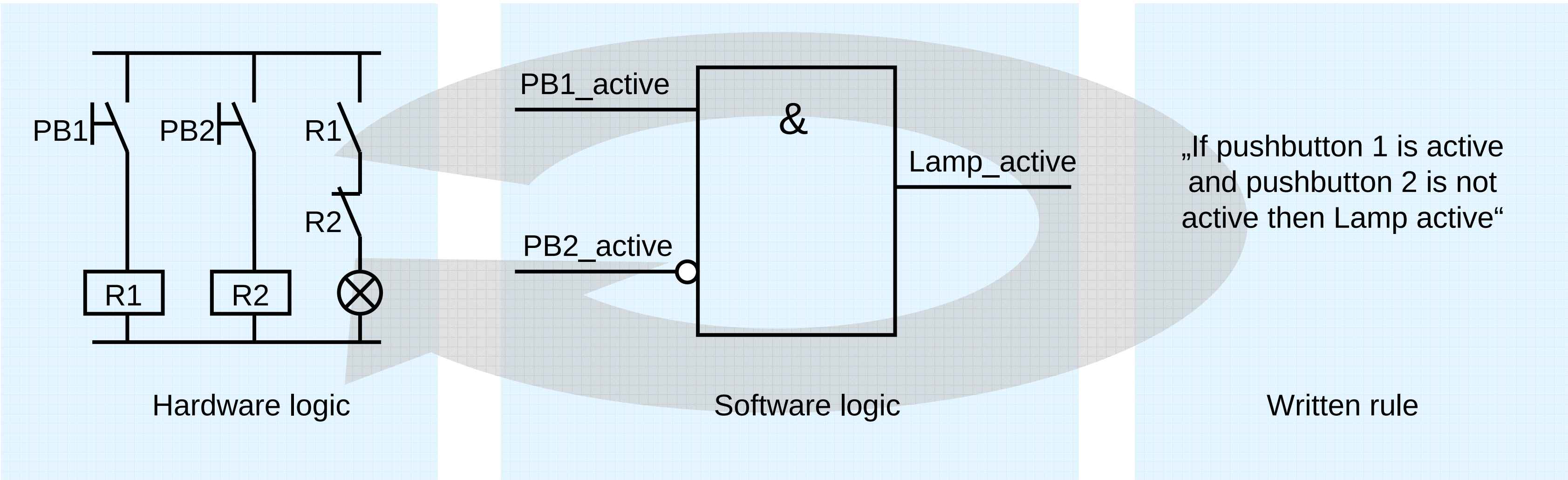
How to include rules for human (Instructions on how to act)?

Approach:

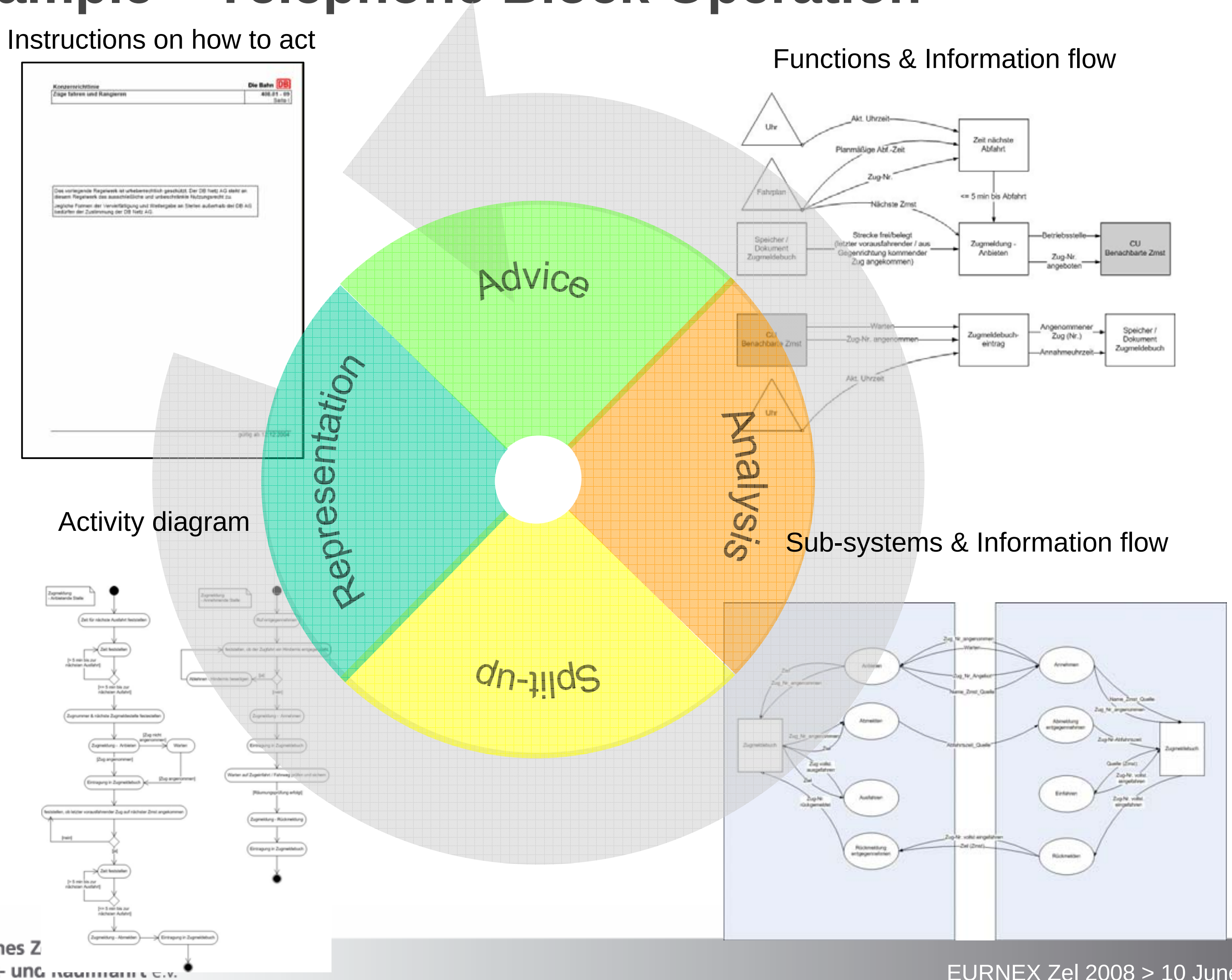
- Consider driver as a sub-system receiving and generating information

Validation

- Transformation from technical system to written rule and vice versa



Example – Telephone Block Operation



Findings of the Example

- Information on track occupancy is important
- Information on track occupancy is stored twice (train report book in offering and accepting train reporting point)
- **But:** Information on track occupancy must be checked only once (when train shall be offered, but not for acceptance)
- In „Instructions on how to act“ the rule for the train acceptance is umbiguous („accept when no conflict exists“ – but what are the conflicts?)

General findings

- Rules must be formulated in a way that it can be checked against compliance unambiguously ⇨ no fuzzy formulation
- Rules must use clearly defined, unambiguously input and output

Conclusions

- The tool presents components and information paths of a system
- The tool highlights the safety-related components and information paths
- Human involvement and weaknesses in the rules for operation can be identified
- With this knowledge ways to support the staff in its tasks can be developed
  - ⇨ staff can be relieved from safety-related tasks / replaced by more reliable systems and deployed in other services

- For analysis of further characteristics of the system more attributes can be assigned to the system elements (e.g. kind of processing unit, communication channel, ...)
- Computer supported analysis using a database ⇨ Assessment after modification of system / rules easy; only modified parts have to be updated

Thank you for your attention!

Contact

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