MoSiS

Model of Safety Layers in the Railway System

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About myself

- Dipl.-Ing. Markus Pelz
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  - Research assistant at DLR since 2005

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German Aerospace Center
Institute of Transportation Systems

Residence:	Braunschweig and Berlin
Since:	March 2001
Director:	Prof. Dr.-Ing. Karsten Lemmer
Employees:	Presently 100 employees from various scientific disciplines

- **Fields of research**
  - Automotive
  - Railway systems
  - Traffic management

- **Range of tasks**
  - Basic research
  - Creating concepts and strategies
  - Prototype development

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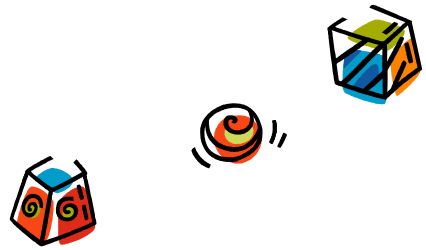
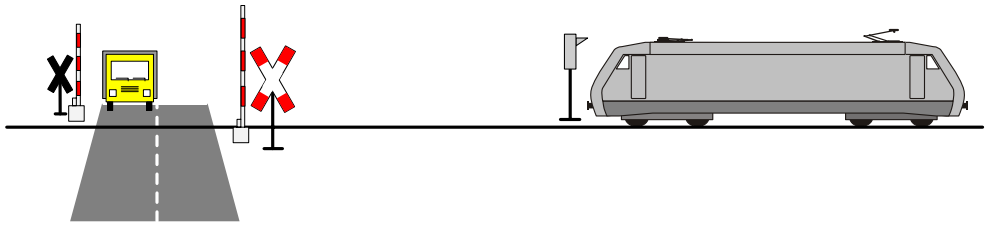
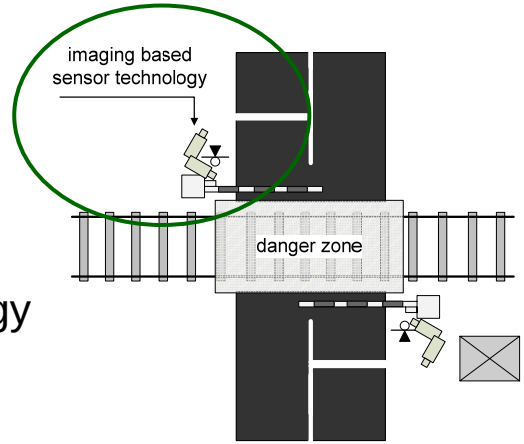


Motivation

Motivation
Initial Situation

- Railway system is one of the safest transport systems but…
  Risks still exist and will always exist!
  - 17 % of all railway accidents happened at level crossings (EU, 2005)[1]
  - 880 killed or seriously injured at level crossings (EU, 2005)[1]





- Problem: Maintaining and improving safety is expensive
- Alternative: Improving safety by using low cost technology

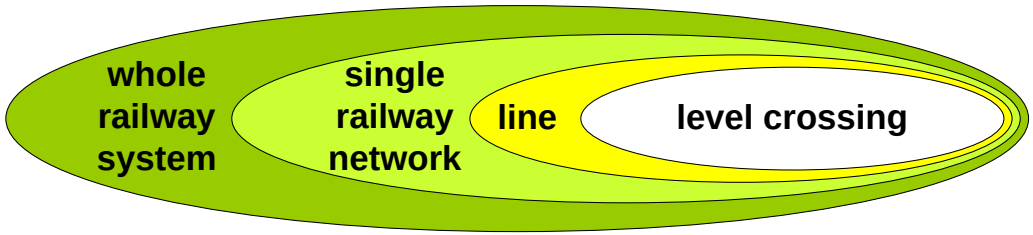
- The aim is to build a model / a tool
  - that helps showing that low cost technology works appropriately
  - that helps increasing organisational and technical safety in the railway system

[1] Eurostat 2007

Motivation
Approaching MoSiS

- Steps
  - Analysis of railway accidents
  - Identification of gaps in the safety concept
  - Find safety layers in the railway system
  - Close gaps to improve safety

- Starting point: level crossing



- Model of safety layers (MoSiS) has
  - to assist in creating a custom-built, cost-effective safety concept without neglecting safety and
    - helps sustaining low-density lines
    - helps creating new level crossing safety technology

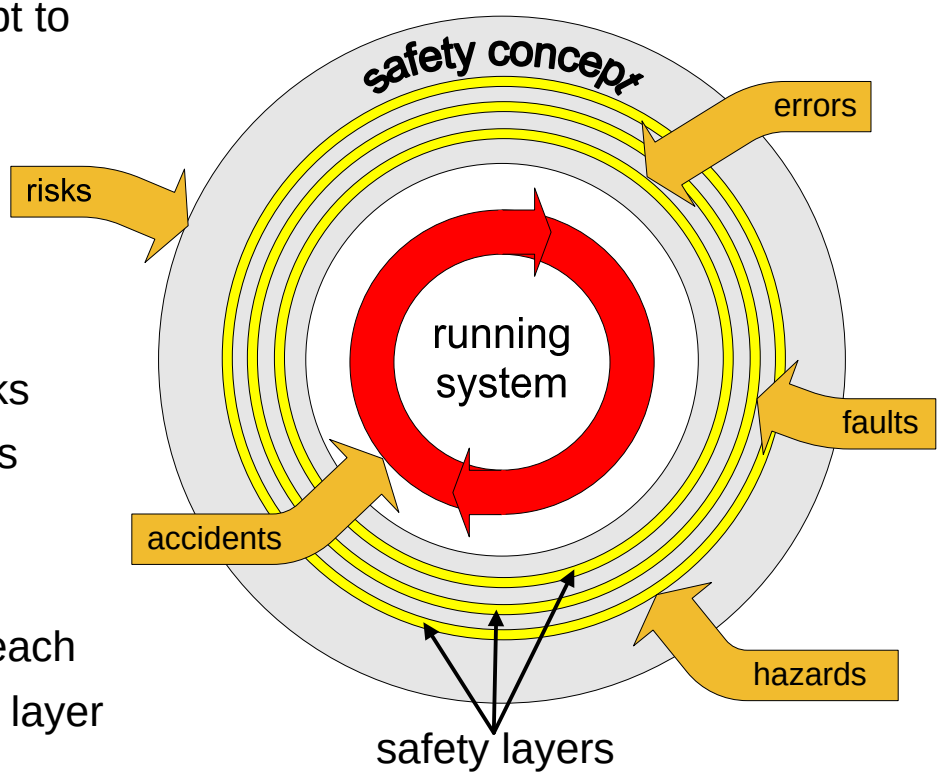
Basics

Safety Layers
Ensuring the Safety of a System

- Every system has a safety concept to ensure a certain safety level

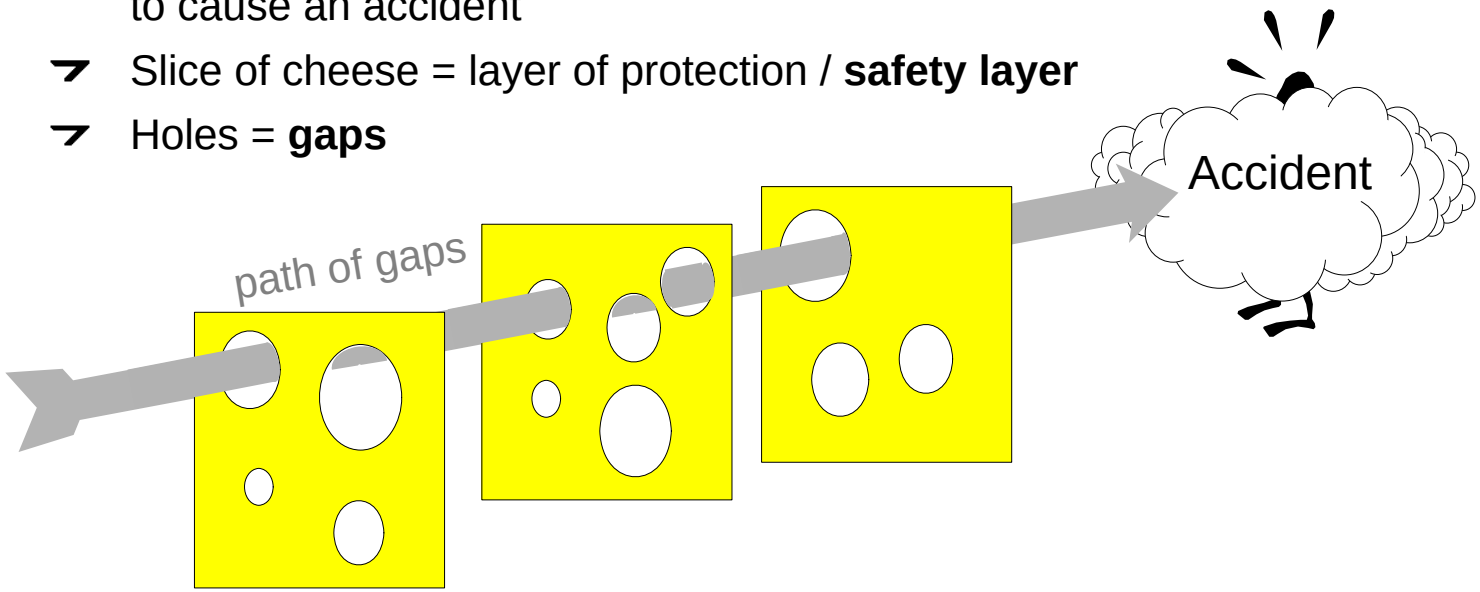
- Risks always exist
- Safety layers exist
  - to protect the system
  - to mitigate hazards and risks
  - to intercept faults and errors
  - to prevent accidents

- Absolute safety is impossible to reach
- Every safety system, every safety layer will have gaps



Swiss Cheese
Visualisation of Gaps and Layers

- Swiss Cheese Model by James Reason
  - Illustrates that it usually takes more than one single failure to cause an accident
  - Slice of cheese = layer of protection / **safety layer**
  - Holes = **gaps**

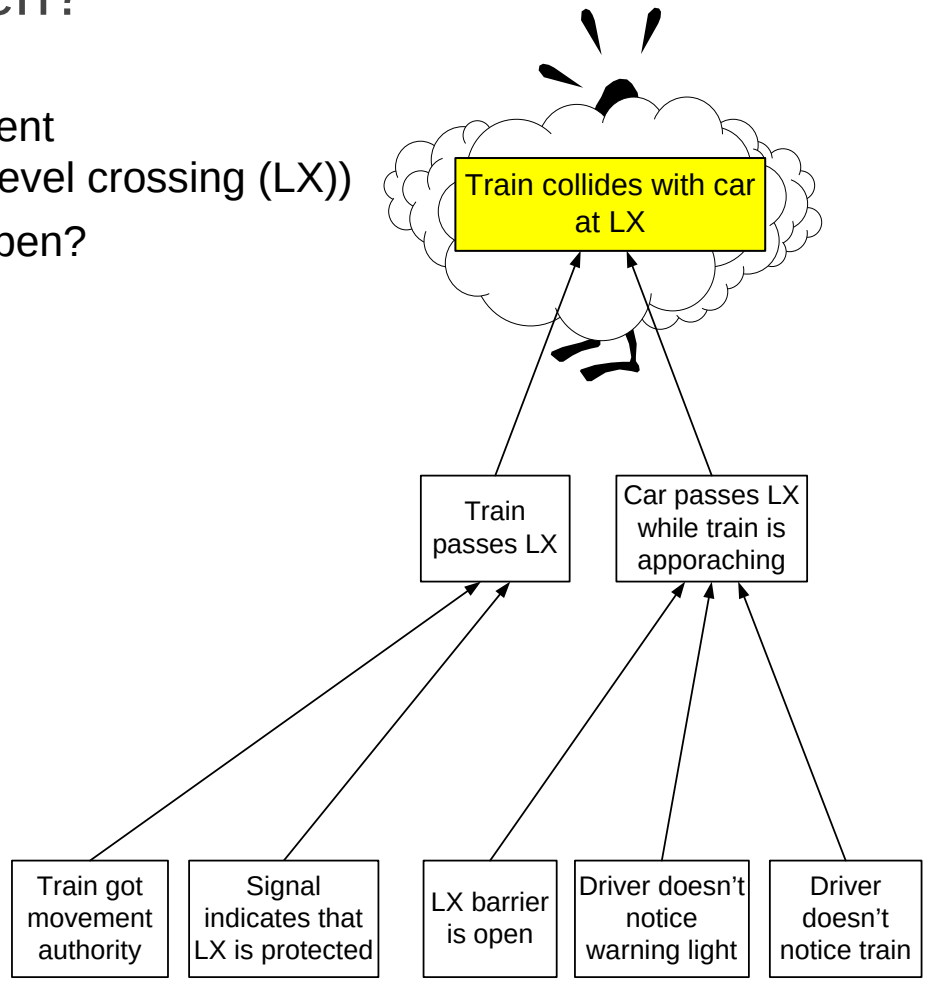


- Path of gaps must go through all safety layers before it comes to an accident
- Path of gaps reveals how the safety concept failed

Accident Analysis
Why do Accidents happen?

- Find out how it came to an accident
  (e.g. collision of train and car at level crossing (LX))
  - Why did this accident happen?
  - What went wrong?
- Ask for
  - reasons instead of guilt
  - causal factors

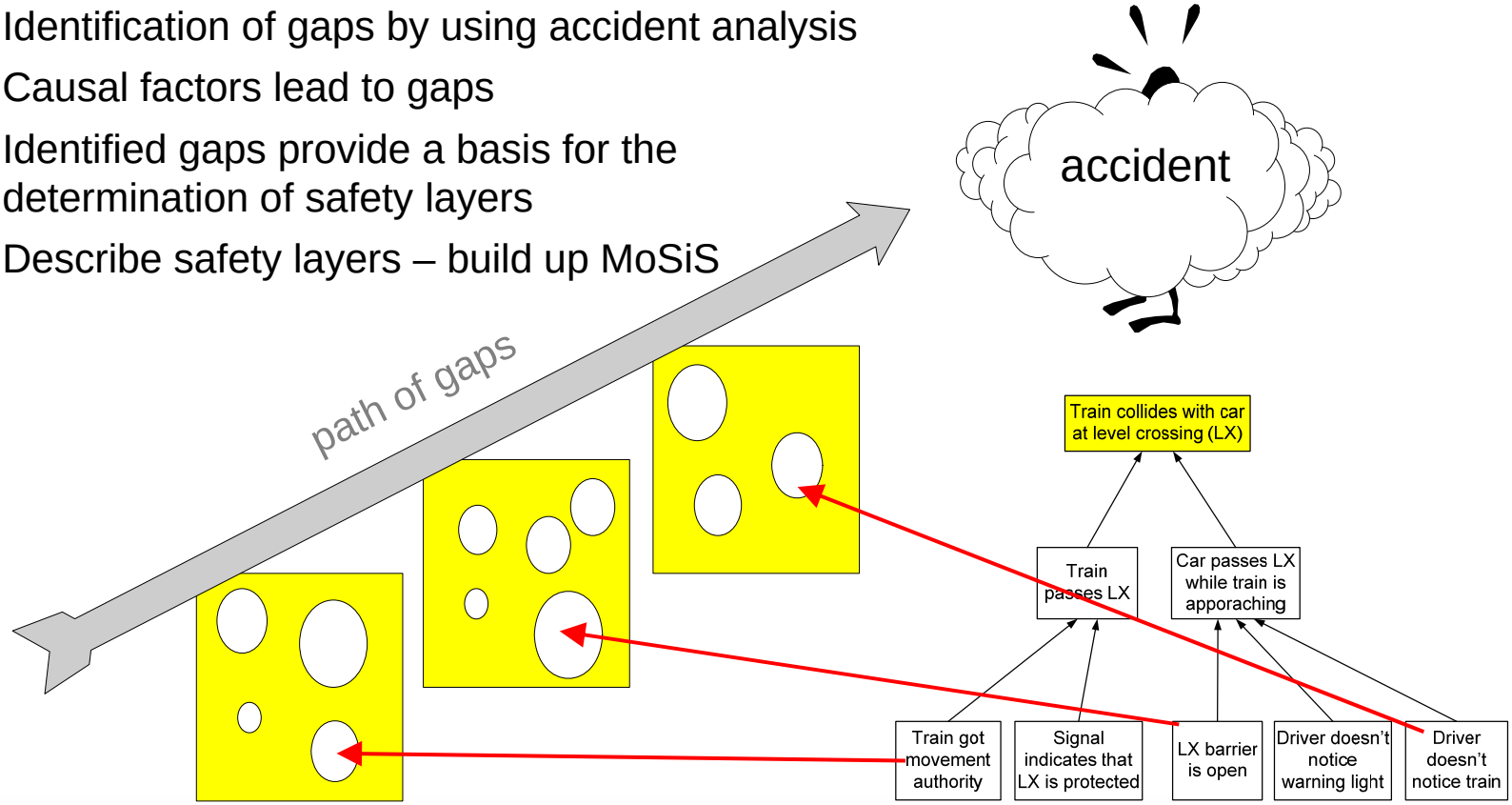
- Why-Because Analysis (WBA)
  - rigorous causal reasoning
  - graphical representation
  - easy to understand



MoSiS - Building Model of Safety Layers

MoSiS
Combining WBA and Swiss Cheese

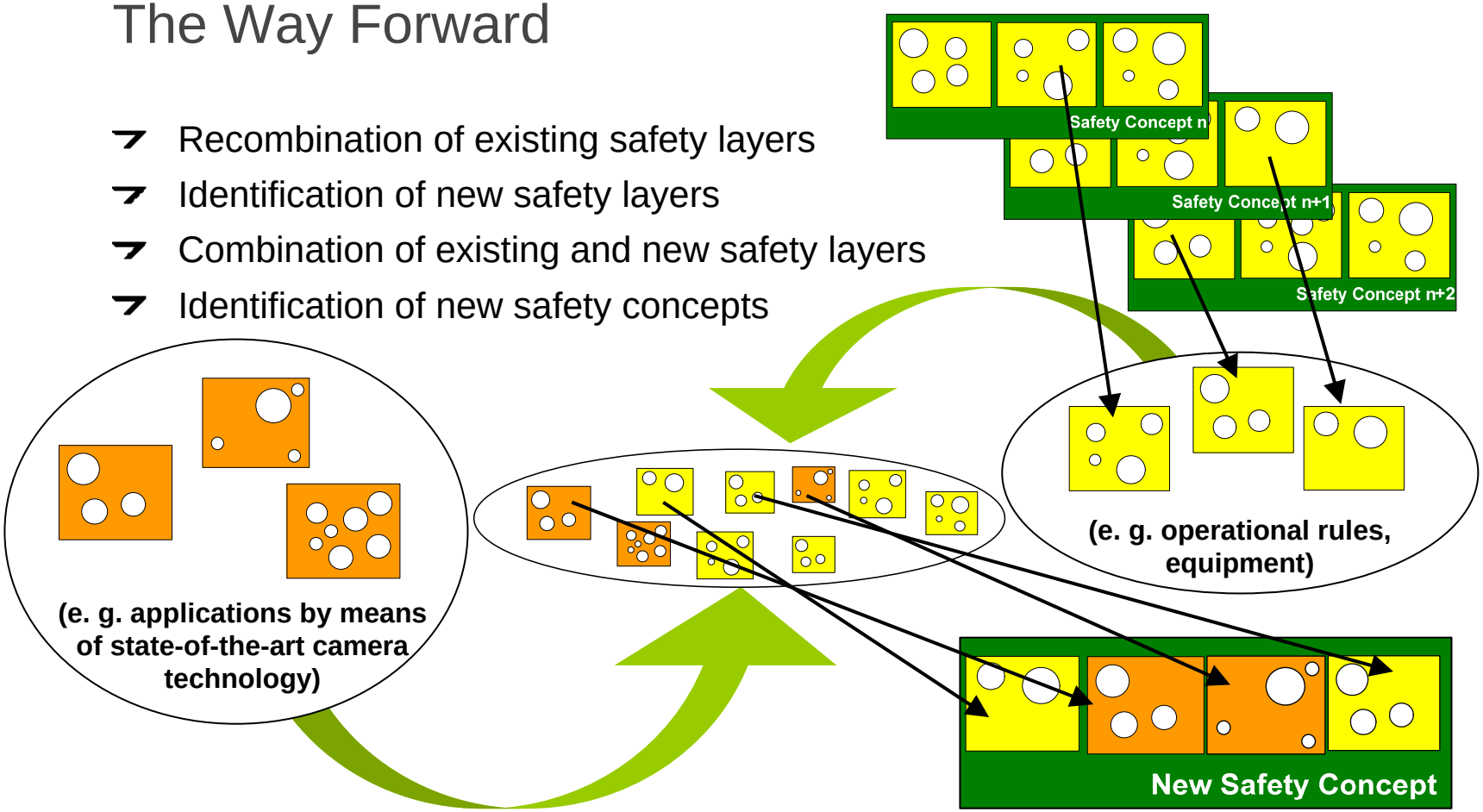
- Analysis of the safety concepts in the railway system
- Identification of gaps by using accident analysis
- Causal factors lead to gaps
- Identified gaps provide a basis for the determination of safety layers
- Describe safety layers – build up MoSiS



MoSiS

The Way Forward

- Recombination of existing safety layers
- Identification of new safety layers
- Combination of existing and new safety layers
- Identification of new safety concepts



- Aim: validation of new safety concepts which use low cost technology

Theses

- The railway system is one of the safest transport systems we have

- MoSiS is expected to provide the following benefits:
  - Identification of flaws in the railway system
  - Modelling of safety layers
  - Possibility to add, to exchange and to recombine safety layers
  - Possibility to optimise the safety concept in order to reduce costs
  - Possibility to improve safety systems
  - Possibility to validate technology and operational scenarios

- MoSiS will be helpful for realising safety cases

Thank you for your attention!

Any Questions?

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