

Curtailing the Impact: Approaches for Recovery Management in Transport Systems

A CONTRIBUTION TO AN ADVANCED DISASTER MANAGEMENT

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Introduction

Extreme Weather – a topic of high importance and public awareness

Independency from weather?!
(PR campaign DB 1966)



German Railways, Winter 2010/11



Autobahn near Rostock, Apr 2011



Dublin Airport, Febr. 2009



Broken Electric Pylon near Münster, 2005

Operational problems: always disastrous for the image,
partly dangerous – and sooner or later business relevant

Agenda: WEATHER workshop 3

1. Transport, Communications – and Disasters
2. Report about a TU Dresden research project
3. Towards a Risk Culture

Transport, Communications – and Disasters

Transport and Communications Systems play various roles...

- **are threaten by external influence,**

(damaged by natural or anthropogenic causes)

- **can be often a potential origin of danger,**

(high velocities & masses, density, dangerous goods)

- **are an important element of disaster recovery,**

(logistics: supply, evacuation, cleanup efforts)

- **are transmitters of disasters and their effects.**

(diseases and epidemics, under-/ overload of various flows)

Extreme Weather Events: Impact on Transport Networks

- ...local or regional impact – national or continental effects
- ...extremely heavy / strong and/or extremely unusual
- ...inside protection strategies or outside protection strategies

Not every extreme weather event must be a disastrous event causing problems in a transport network.

But why are these systems so vulnerable?

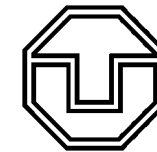
Vulnerability of man-made structures

- Complex and close networked systems
 - Rising values of facilities
 - Static systems in a dynamic /chaotic environment
 - Settlement density
 - High range / impact by few humans
 - Lack of risk awareness in politics, business and privacy
- ...lead to an **increasing** vulnerability

What can research, development, consultancy contribute to make things better?

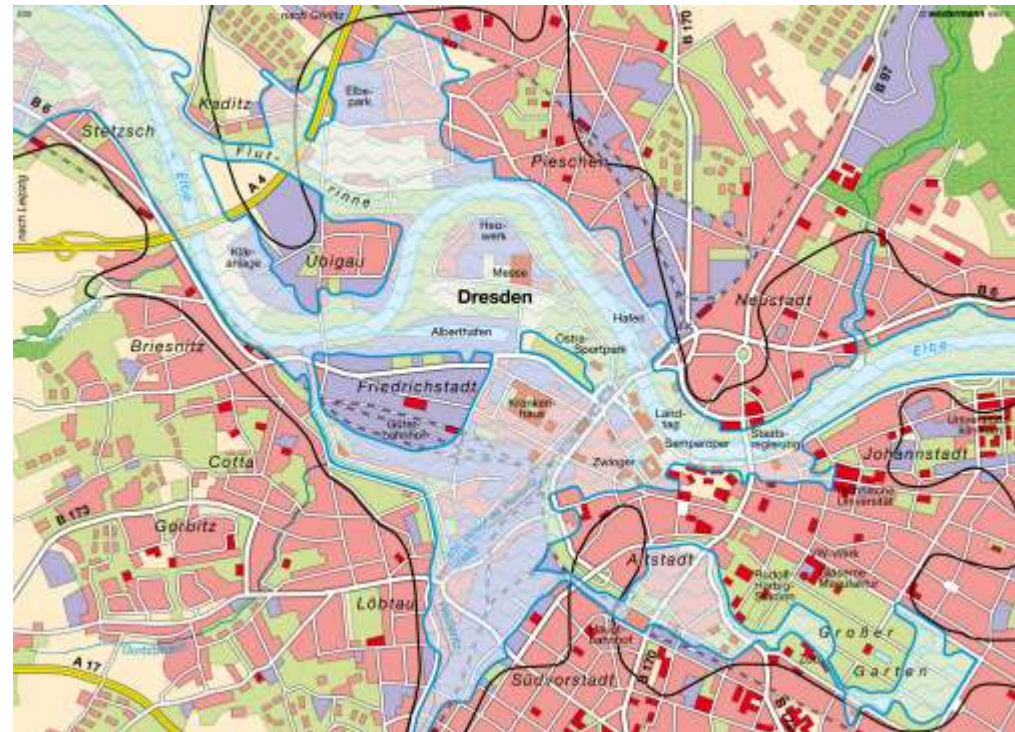
Example: Extreme weather as a research topic

Computer based analysis of causality networks and simulation of evacuation in case of disasters using the example of the August-flooding of the River Elbe



**TECHNISCHE
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(Helbing et al, 2003-3/2010, DFG project He 2789/6-1)



Curtailing the Impact: Approaches for Recovery Management

What happens next?

- Specification and prognosis of disaster scenarios by modelling shall be
 - for **disaster precautions** (scenario analysis),
 - for **disaster recovery** forces, authorities and population.
 - for subsequent **evaluation** of disaster events and their recovery measures for scientific purposes.

What to do?

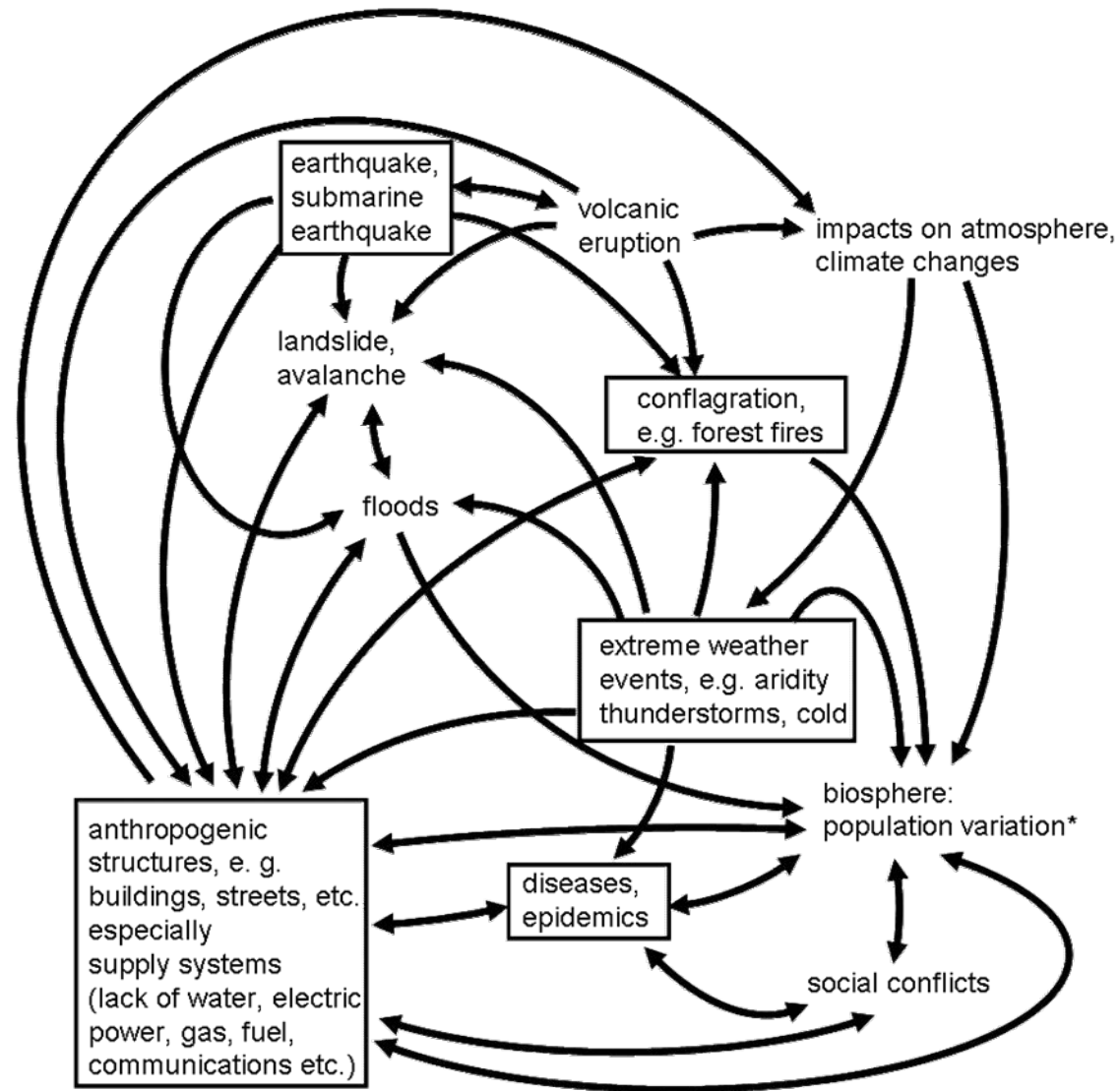
- The interconnection/ combination with other models:
 - **Traffic network models**: load behaviour (overload, underload), routing
 - **Logistic models**: optimization of recovery measures, esp. disaster logistics

Methodology

- a) Analysis of interacting network elements, simulation of disaster scenarios, evaluation of probable disaster dynamics and finding conclusions for disaster management with **causality networks**,
- b) Traffic and Evacuation: **Software tools** for short-term preparation of large scale evacuations in combination with enhanced traffic planning and logistics models and planning software.

Source: Dresden University of Technology

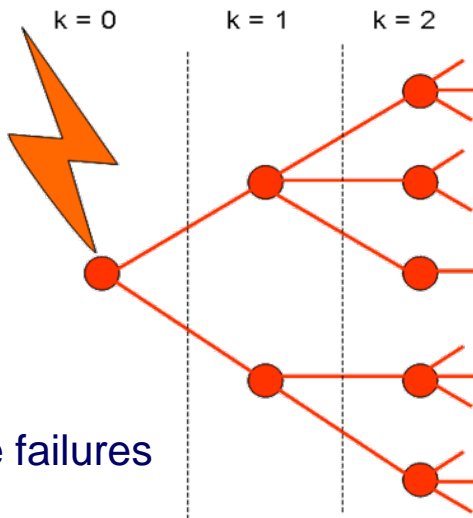
Analysis of Causality Networks: Disasters cause Disasters



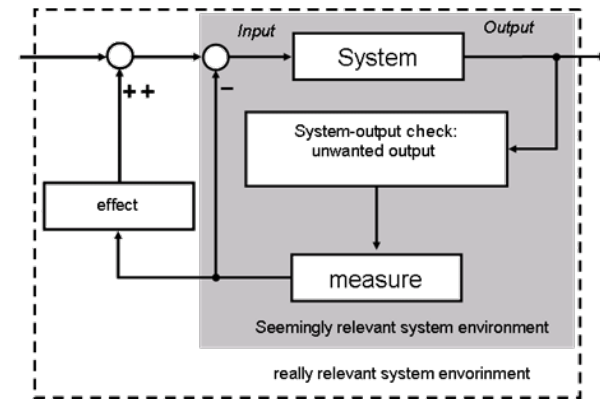
)* Reaction of the biosphere: unusual population, all kind of organisms (incl. humans) can be affected in form of population increase or decrease, perturbing the balance of available and required resources including crop loss, shortage of food and famine, explosion of pathogens, pest etc.

For more details see other figures.

Analysis of Causality Networks: : Disaster Dynamics



Cascade-like failures

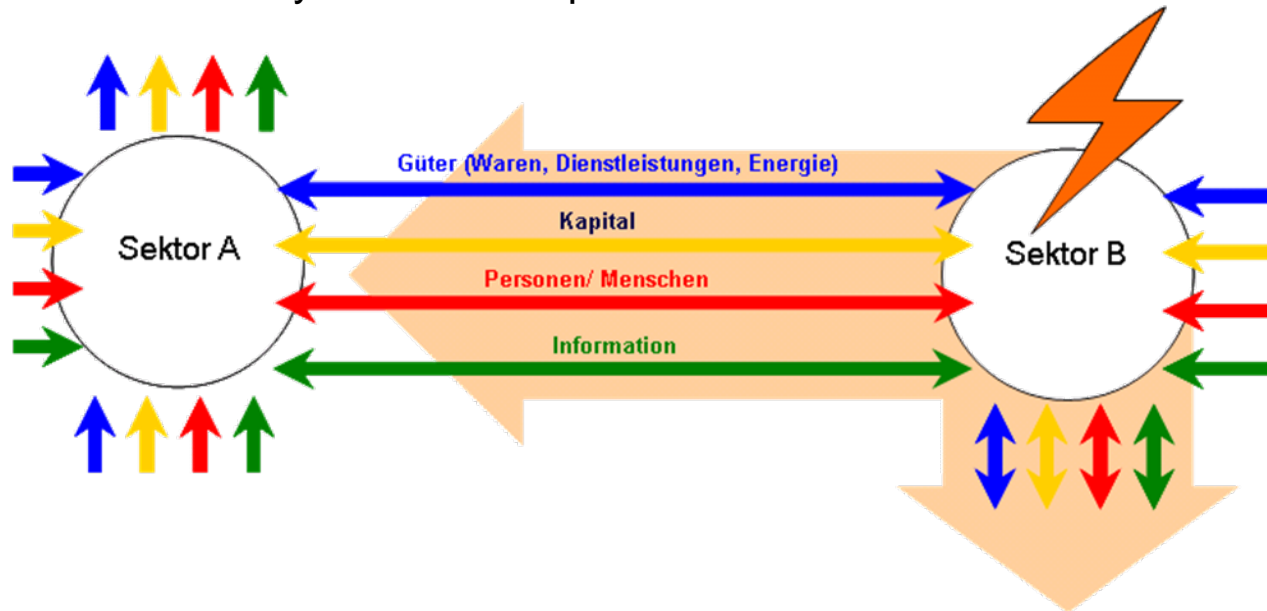


Vicious cycles

Source: Dresden University of Technology

Analysis of Causality Networks: Causal Connections

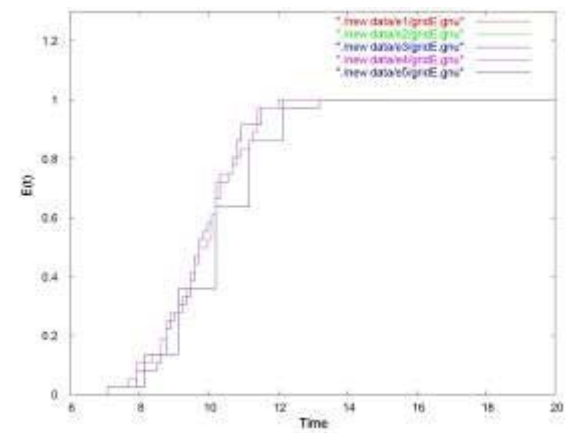
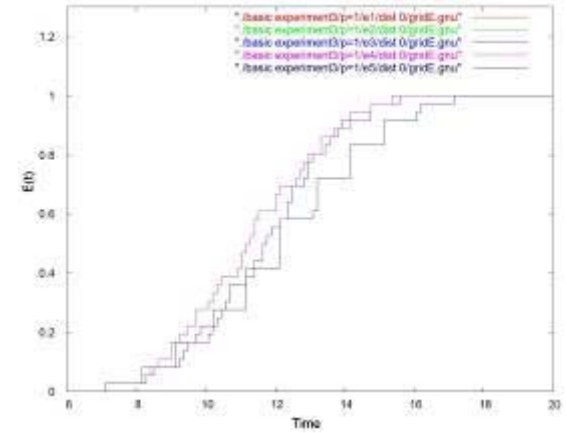
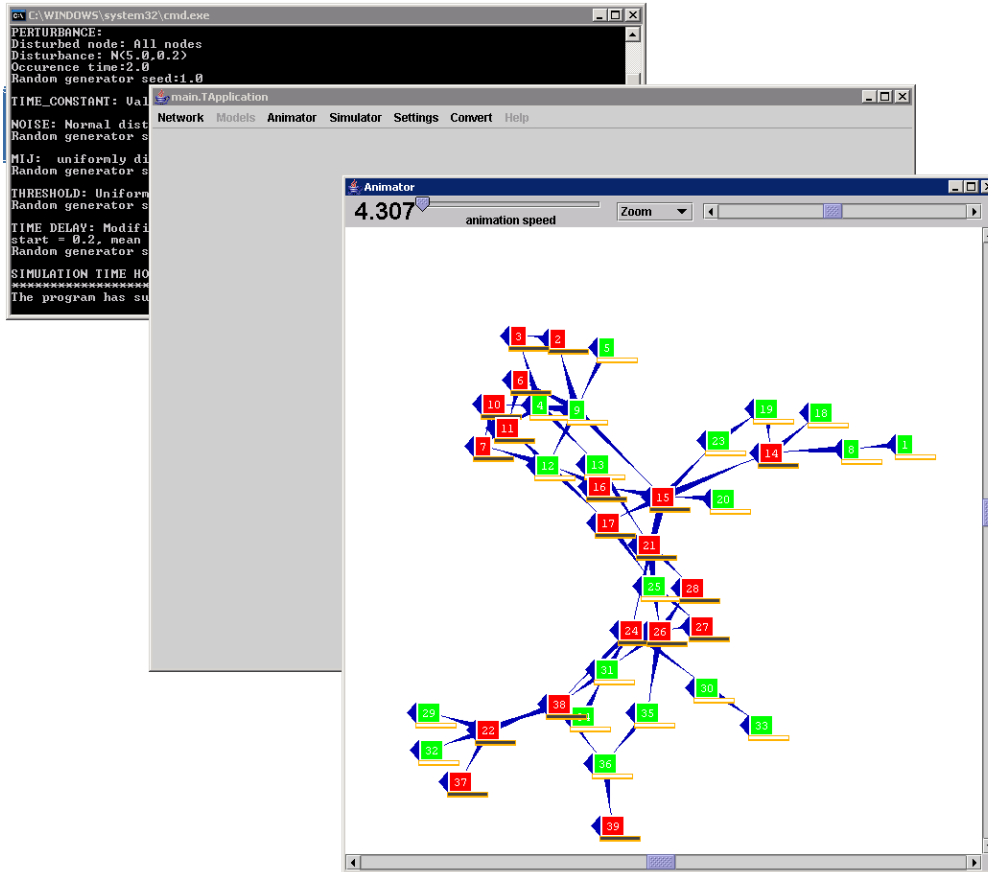
Sector infection by lines of transport and communications



- Effects of an internal event spread along physical routes – along the usual flow/ exchange lines, e. g. **goods** (freight, services, energy), **capital**, **persons/ humans**, **information**.
- The variety of the flow transmits the effects from one sector to its neighbors.

Source: Dresden University of Technology

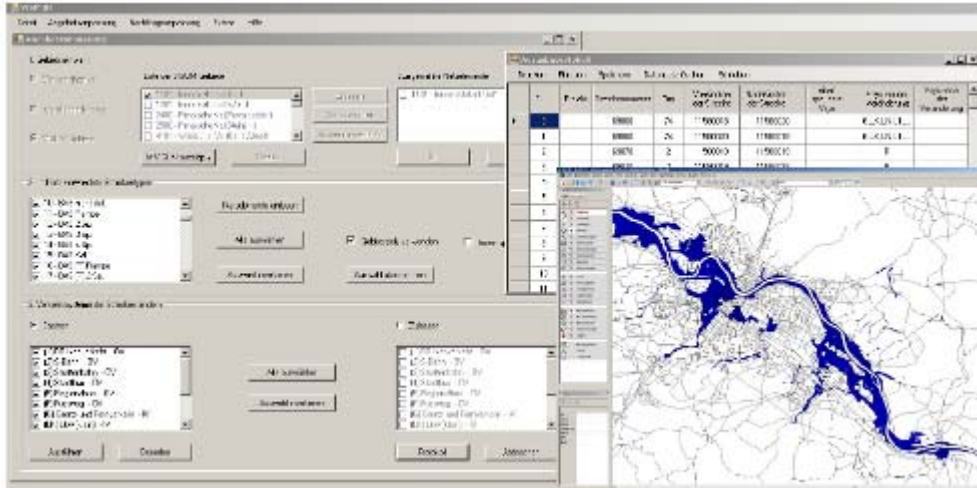
Modelling and Simulation of Synthetic Causality Networks



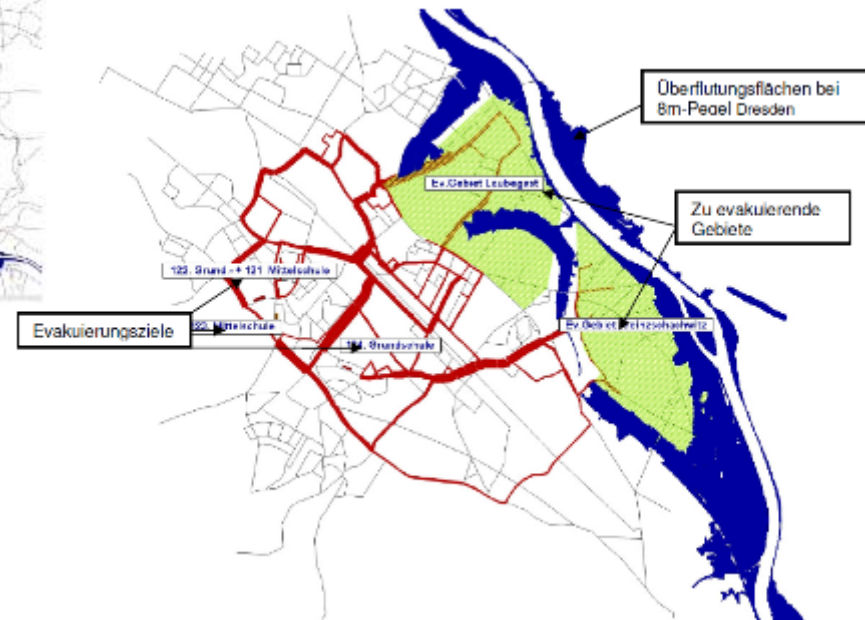
Source: Dresden University of Technology

Traffic and Evacuation: Software for Planning and Recovery

VISMOD – Impact on Urban Transport Networks



VISEP – Evacuation Planning



Further Information

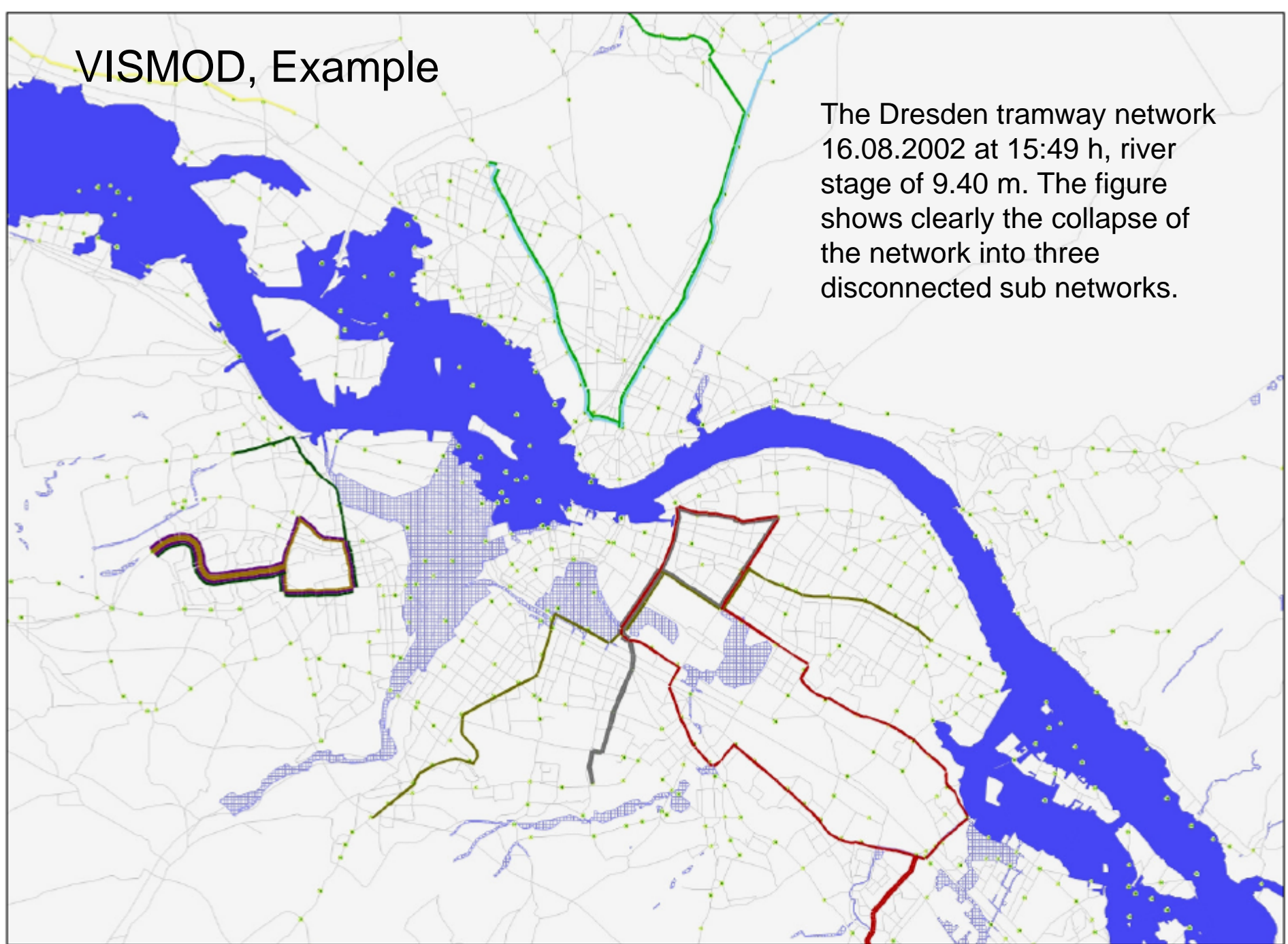
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Maik Boden, TU Dresden

www.vwi.tu-dresden.de/projects/disaster

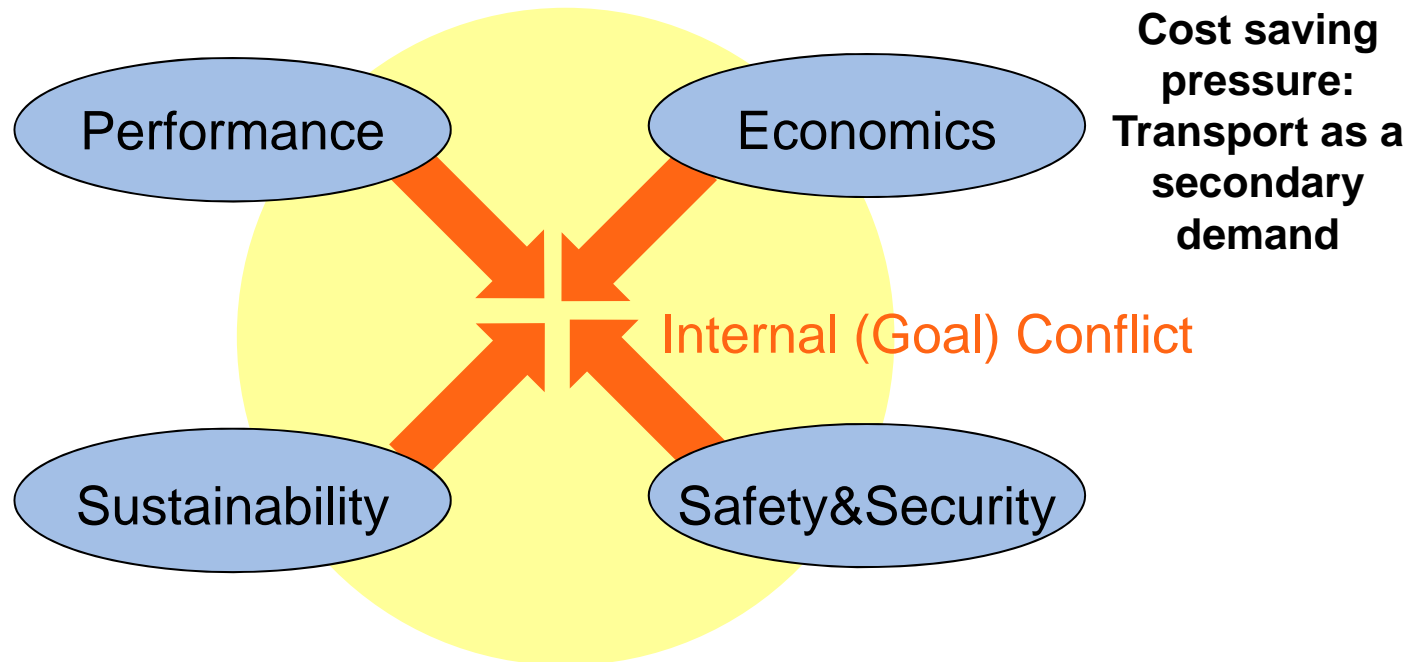
VISMOD, Example

The Dresden tramway network
16.08.2002 at 15:49 h, river
stage of 9.40 m. The figure
shows clearly the collapse of
the network into three
disconnected sub networks.



Towards a Risk Culture: Transport System / Service Provider

Design Criteria of Transport Systems



External conflict: Individual (business) risk
vs. individual (user / costumer) risk
vs. public (social functionality) risk

Towards a Risk Culture: The Users and the Public

- Communication to users and public
 - Risk
 - (Self-) Protection
 - Recovery
- Individual and public rights and duties
 - privates and business
 - Esp. were users are “Self-Service-Providers”
(individual car drivers)
- Technical (un-) abilities
- Training, Education
- Media Competence: Don't let you panic.

In daily life, users / public accept moderate transport service prices and a moderate protection against extreme weather impacts (while there is a high / acceptable overall safety & security) even if t they say other things in case of extreme events.

Towards a Risk Culture: Government, Administration

Responsibility

- Over all risk management
- Monitoring of markets and branches
- Rules for all players – setting & enforcing
- Parameter setting regarding the level of protection on behalf of the users and citizens (balance between public and business)
- Realisation and/or financing for “public protection measures” on behalf of all



Welcome to TÜV Rheinland.

In Motion for Mobility. In Motion for You.

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