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Challenges in Information Systems for Disaster Recovery and Response

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3. GI/ITG KuVS Fachgespräch
Ortsbezogene Anwendungen und Dienste

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Overview

1. Motivation
2. User Requirements
3. Application Area: Disaster Recovery and Response
4. System Architecture Information Flow
5. Challenges
6. MIKoBOS
7. Mobile Test Lab
8. Innovations
9. Conclusion

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1. Motivation

The year 2005 was marked by weather-related natural catastrophes. Roughly half of all the loss events recorded were windstorms, with costs to be borne by the world's economies exceeding US$ 185bn.

Munich Re has long been warning that increasing global warming will be accompanied by extraordinary weather related natural catastrophes and explaining why there is a likelihood of greater loss potentials. The company's fears were confirmed in 2005.

Quelle: http://www.munichre.com/publications/302-04772_en.pdf

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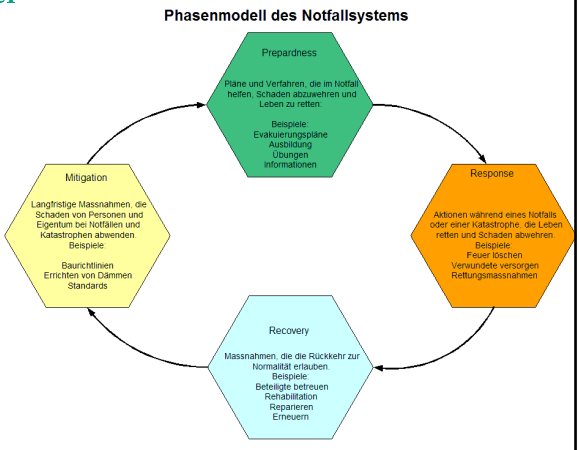
E-Emergency Model



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1. Motivation

Disasters and Catastrophes

- Accidents
- Earthquakes
- Floods
- Terror attacks
- Diseases
- …

Disaster recovery and response require a timely coordination of the emergency services

In a Large-Scale Emergency Response Operation many different units are involved:

- Fire Brigade
- Police
- Emergency Medical Services e.g. Red Cross
- Technical Support Organizations e.g. THW (Technisches Hilfswerk)
- Authorities at Local, Regional, National Level

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2. User Requirements

Study on disaster and emergency management systems:

- Integration and linking of information
- Availability of communication, redundancy of links
- Fast data access
- Timeliness and updating of information
- Standardization of information

Coordinating and controlling an operation needs

- improved **Communication and Coordination** within and between Organizations by **digital technology**

Nickel, S., et al. (2002). Marktanalyse Katastrophen- und Notfallmanagementsysteme (in German), Fraunhofer Gesellschaft (eds.)

3. Application Area: Disaster Recovery and Response

Characteristics

- Not predictable
- Information provision in realtime
- No precise planning
- No infrastructure

Each disaster/catastrophe is unique

- Situation
- Environment
- Resources

Success and efficiency depends on a few aspects

- up-to-date information being propagated up and downstream efficiently
- effective resource management
- well-organized cooperation and coordination between the different services

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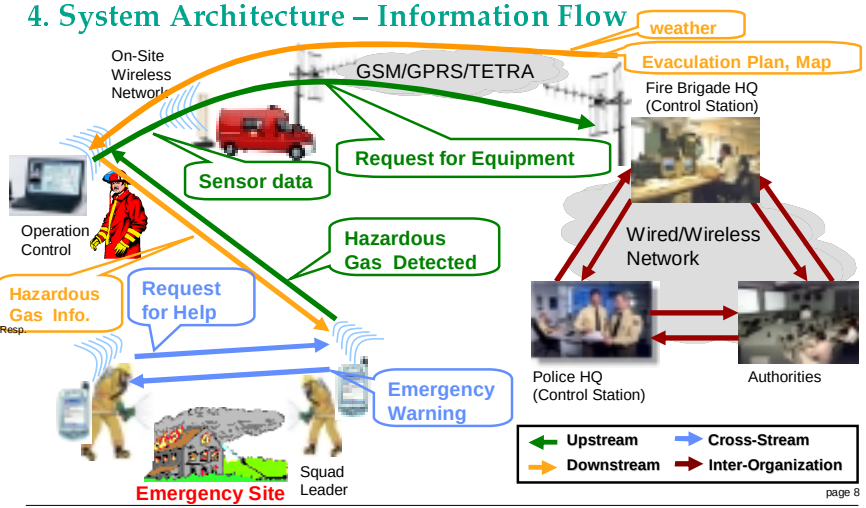
4. System Architecture – Information Flow



5. Challenges (some selected)

Networking
- robust communications at WAN, LAN, PAN, and BAN

Configuration
- Auto / Self configuration
- Configuration of devices
- Discovery of services

Data Management
- Reliability
- Performance

Resource Scheduling

Positioning

Security

5. Challenges – Configuration

Actors:
- Stationary (Fire Brigade HQ, Police HQ)
- Semi-mobile (Operation control)
- Mobile (frontline personnel, e.g. fire fighters)

Topics:
- Auto / Self configuration
  - Actors needs to be integrated
  - Resource conflicts (use multiple links)
- Configuration of devices
  - Integration and sync. of devices
- Discovery of services
  - Access services on demand (hazard-DB)

5. Challenges – Data Management

Motivation:

- unreliable communication environments
- low data transmission rates at some level
- different processing and storage capabilities of the devices

Challenges:

- Reliability (complete information)
- Performance (fast information provision and access)
- Bandwidth varies -> data must be transformed, de/aggregated -> flexible data structures

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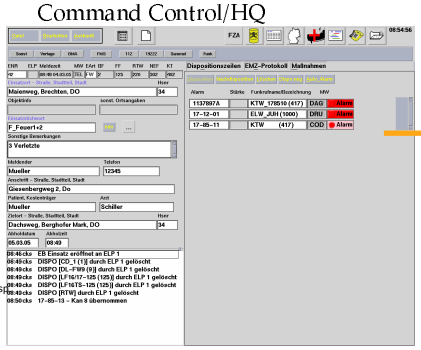
MIKoBOS
Mobiles Informations- und Kommunikationssystem für BOS

6. MIKoBOS Functions – data transfer down stream

Command Control/HQ



Operation Control (TEL)

Upstream
Downstream
Cross-Stream
Inter-Organization

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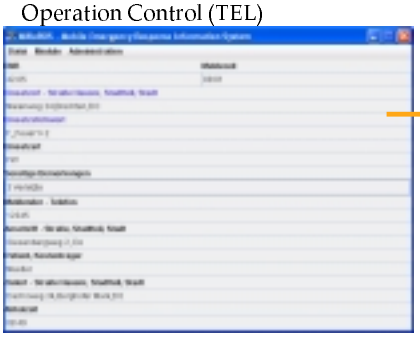
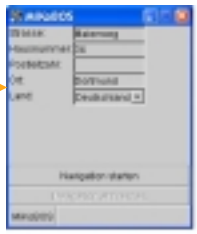
Mobiles Informations- und Kommunikationssystem für BOS

6. MIKoBOS Functions

Operation Control (TEL)



Squad Leader



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Upstream Cross-Stream
Downstream Inter-Organization

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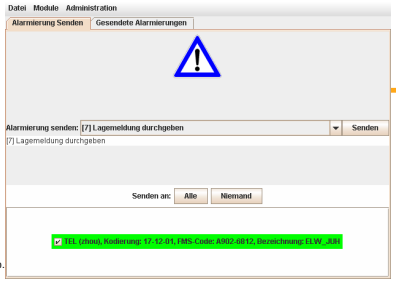
6. MIKoBOS Functions – transfer FMS messages

Command Control/HQ



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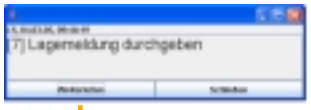

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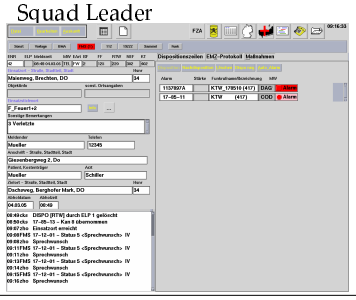
Squad Leader

Operation Control (TEL)

Squad Leader



Upstream Cross-Stream
Downstream Inter-Organization

MIKoBOS
Mobiles Informations- und Kommunikationssystem für BOS

6. MIKoBOS Functions – transfer photos

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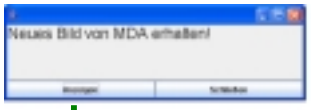

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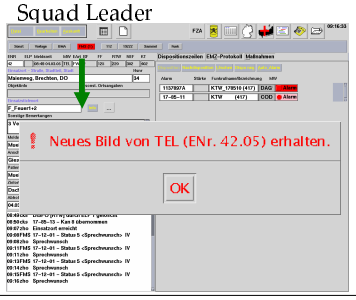

Upstream Cross-Stream
Downstream Inter-Organization

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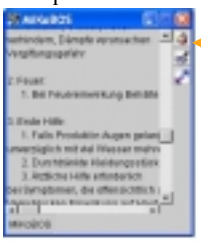
6. MIKoBOS Functions – hazard-DB access

Squad Leader



Operation Control (TEL)

Upstream
Downstream
Cross-Stream
Inter-Organization

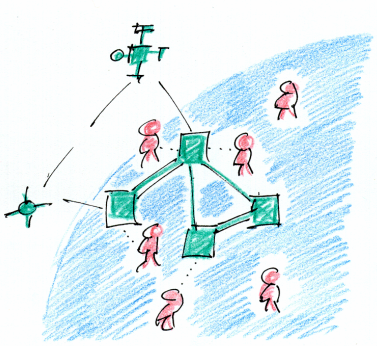
8. Outlook/Innovations

- Location/context-based service discovery
- Database management: "flying elephants"
- Distributed data storage based on grid computing and peer2peer/p-grid (Bnode)
- Proactive information provision (Preloading, Prefetching and caching/hoarding)
- Indoor positioning (using auto init/setup)

9. Conclusion

MIKoBOS Integrated communication and information system

- To develop an IS for Disaster Recovery and Response several IT research disciplines need to work together
- Information flow (up-, down-, cross stream, inter-org)
- Research areas (challenges)
  - *Networking*
  - **Configuration**
  - **Data Management**
  - *Resource Scheduling*
  - *Positioning*
  - *Security*



Thank you very much for your attention!