Challenges in Information Systems for Disaster Recovery and Response

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Ortsbezogene Anwendungen und Dienste

Overview
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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 wind storms, with costs to be borne by the world’s economies exceeding US$ 155bn.

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.

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 (Technische 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

3. Application Area: Disaster Recovery and Response

Characteristics

- Not predictable
- Information provision in real time
- 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

4. System Architecture – Information Flow

- On-Site Wireless Network
- Operation Control
- Sensor data
- Request for Equipment
- Hazardous Gas Detected
- Request for Help
- Evacuation Plan, Map
- Fire Brigade HQ (Control Station)
- Wired/Wireless Network
- Authorities
- Emergency Site
- Squad Leader
- Emergency Warning

- Upstream
- Cross-Stream
- Downstream
- Inter-Organization
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-DDB)
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
6. MIKoBOS Functions

Operation Control (TEL)  Squad Leader

Upstream  Cross-Stream
Downstream  Inter-Organization

6. MIKoBOS Functions – transfer FMS messages

Command Control/HQ  Operation Control (TEL)  Squad Leader

Upstream  Cross-Stream
Downstream  Inter-Organization
6. MIKoBOS Functions – transfer FMS messages

Upstream  Cross-Stream
Downstream  Inter-Organization

Squad Leader  Operation Control (TEL)

Squad Leader

Upstream  Cross-Stream
Downstream  Inter-Organization

Squad Leader  Operation Control (TEL)
6. MIKoBOS Functions – hazard-DB access

Squad Leader  Operation Control (TEL)

- Upstream
- Cross-Stream
- Downstream
- 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 (Enode)
- Proactive information provision (Prefetching, Prefetching, and caching/boarding)
- Indoor positioning (using auto in&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!