Effective communication in a crisis - e-Triage

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When a disaster occurs, emergency response services are strained to the limit. What is available in terms of staff and vehicles is often inadequate for treating and transporting all victims immediately. Moreover, bottlenecks may occur in the transport of relief material to the site. In such a crisis, the *e-Triage* database system developed by DLR serves to optimise the deployment of available resources.

Whether we are looking at the Duisburg Loveparade disaster (2010), the pile-up on the A8 motorway (2010), or the chemical accident at Mönchengladbach (2008) – rescue forces need to set priorities whenever they are confronted by large numbers of injured or sick persons. Those first to arrive at the site begin by making a rough survey to establish the kind of injuries found, the number of seriously injured to be looked after, and which cases have to be hospitalised as quickly as possible.

So far, survey teams have been using triage tags to classify victims, triage being the name given to the survey process. Based on these tags, victims will be treated and their transport to hospital prioritised by reinforcements arriving later. As the entire information about a patient is recorded on a paper tag that remains with him or her throughout, the command centre can track the situation only with a lengthy time-lag, which makes disaster management considerably more difficult.

Designed for disaster deployment

Rescue forces registering a victim electronically (training situation).

Image: Euro-DMS/Michael Ben Amar.

Under the *e-Triage* project, which is funded by the Federal Ministry for Education and Research (BMBF), DLR researchers are currently working on an electronic system for registering victims, a new database technology that will facilitate efficient communication in a crisis. The system is designed for use in major disasters but also in the daily work of the rescue services.

The objective: to provide the same level of information in real time to all personnel and decision-makers involved in the rescue, transport, and accommodation of victims. Thus, operations can be coordinated quickly, safely, and efficiently, and the rescue chain can be documented automatically for later mission analyses. Hospitals and command centres can access relevant data via web interfaces. In cases of ABC contamination, individuals that have been in contact with the victims can be identified.

Distributed database

The technology that backs up *e-Triage* is complex. The core of the system is a self-organising and -synchronising database that will be installed on all mobile registration units as well as on other computers. It is being developed at the DLR Institute of Communications and Navigation in Wessling (Bavaria). The system is designed not only for disaster management alone but also for any form of distributed wireless data capture.

Yet, the benchmark against which DLR researchers are developing the system is the particular set of challenges presenting themselves at a disaster site. If, for example, local communications structures have been destroyed or did not exist in the first place, data communication is secured by local wireless cells that are connected to the internet and the telephone network via satellite. While the range of these cells is normally adequate, they are, like all wireless communications networks, prone to service disruptions, which are particularly to be expected in unfavourable environments such as buildings and tunnels. Moreover, some cells work on narrow-band standards whose data rates are comparatively low. To ensure that the distributed database can nevertheless synchronise itself reliably, data matching must always be kept as resource-efficient as possible.

The database instances will be installed on mobile registration devices as well as on computers connected to a communication node such as, for instance, a WLAN router in an operations command vehicle. Further entities will be installed on dedicated servers at internet computing centres.

When developing the system, the Digital Networks department of the DLR Institute of Communications and Navigation was able to fall back on a body of satellite communication experience gathered over many years. Scientists from one of DLR's main research areas, astronautics, is involved in this project, which at the same time forms part of DLR´s security research, a cross departmental programme under which defence- and security-related research and development activities are being planned and controlled.

Innovative technology
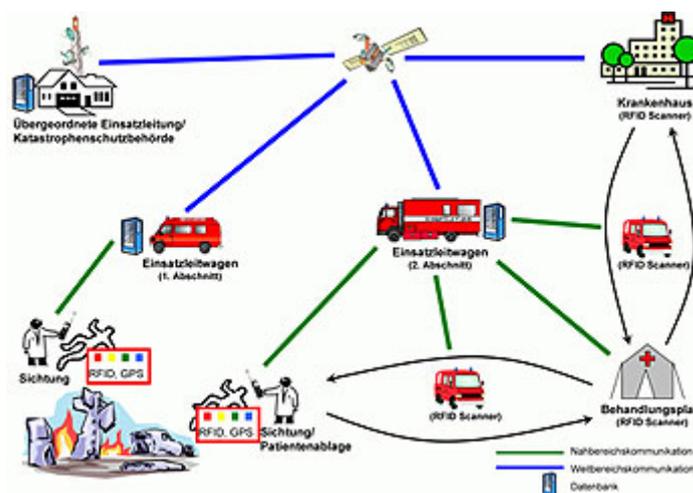
Schematic overview of the data exchange process within the e-Triage system.

Image: DLR.

Essentially, the database system developed by DLR consists of an asynchronous database replicator with a highly efficient synchronisation algorithm. As long as a connection remains stable, the replicator will be used; after a connection failure, the system will automatically switch to an efficient synchronisation process, thus avoiding the need to re-copy entire data records. DLR's new technology not only facilitates the handling of connection failures; the distributed architecture also ensures that information can be gathered quickly even where a rescue

operation is spread over a large area, which would hardly be possible if data storage was fully centralised.

The graphic user interfaces and the satellite-based mobile wireless cells (GSM, TETRA, and WLAN) that form part of the *e-Triage* system are being developed by private business enterprises. The project is assisted by scientists of the psychology department at the Ludwig Maximilian University in Munich. They are to optimise technical applications so that they can be safely operated by mission personnel even when under great stress. Moreover, the development is supported by the Starnberg division of the Bavarian Red Cross, the casualty hospital of the employer's liability insurers at Murnau, the disaster prevention authority of Starnberg county, the firemen's training college at Geretsried, and several emergency physicians. Experts from all these institutions regularly advise DLR's researchers and test the e-Triage technology in the field.

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