



# Research Project e-Triage

## IT-Supported Management of Mass Casualty Incidents

### Coordinator:

Anton Donner

DLR

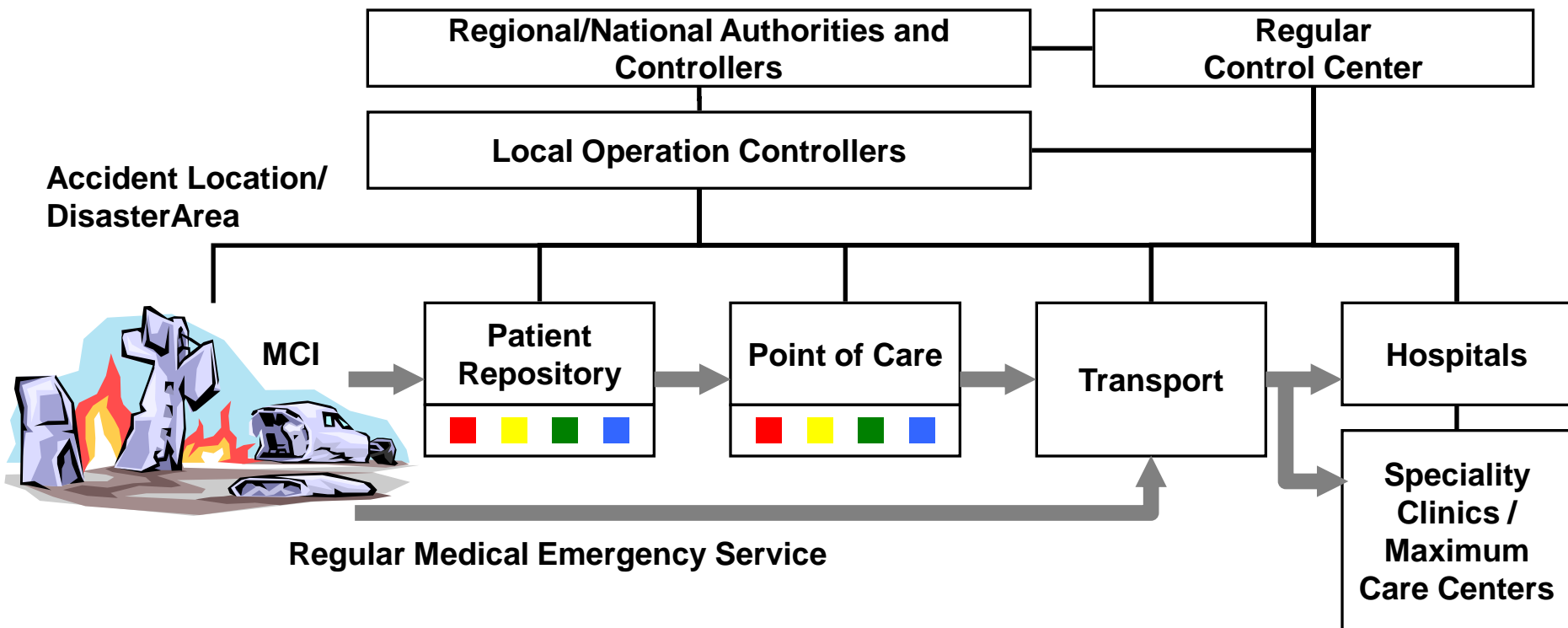
Institute of Communications and Navigation

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Federal Ministry  
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# From Individual Emergencies to MCIs



Patients



Triage



Information flow  
voice or paper



MCI = Mass Casualty Incident

# Registration Tags

## Example: German Red Cross

I  
II  
III  
IV

- I** Immediate (life threatening injury)
- II** Delayed (serious, non life threatening)
- III** Minor (walking wounded)
- IV** No chance of survival (fatal life threatening injury)
- Morgue (pulseless, non-breathing)

**Suchdienstkarte für Verletzte/Kranke innenliegend**

**+** **Anhängekarte für Verletzte/Kranke** **+**  
Registration card for injured/sick persons - Fiche d'enregistrement pour blessés/malades

**Name** Name / **Nom**  
**Vorname** First name / **Prénom**

**Geburtsdatum/-Alter** Date of birth/-age / **Date de naissance/-âge**

**Nationalität** Nationality / **Nationalité**

**Datum** Date

**Patienten-Nr. aufkleben**

Sichtung	1. Sichtung	2. Sichtung	3. Sichtung	4. Sichtung
Kategorie	Uhrzeit/Name	Uhrzeit/Name	Uhrzeit/Name	Uhrzeit/Name
I				
II				
III				
IV				

**Transportmittel** Transport means / **Moyen de transport**

**Transportziel** Destination / **Destination**

<b>Transport</b>	<b>liegend</b>	<b>sitzend</b>	<b>mit Notarzt</b>	<b>isoliert</b>	<b>Priorität</b>
Transport	lying	sitting	with doctor	isolated	Priority
	couche	assis	avec médecin	isolé	Priorité
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	a <input type="checkbox"/>
					b <input type="checkbox"/>

**Innenliegende Suchdienstkarte** enclosed card for triaging service, fiche d'enregistrement ci-jointe

<b>1. Ausfertigung</b>	<b>weitergeleitet</b>	<input type="checkbox"/>
1 <sup>st</sup> Copy, 1 <sup>st</sup> Copie	referred, acheminé	
<b>2. Ausfertigung</b>	<b>weitergeleitet</b>	<input type="checkbox"/>
2 <sup>nd</sup> Copy, 2 <sup>nd</sup> Copie	referred, acheminé	

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front side

**Suchdienstkarte für Verletzte/Kranke außenliegend**

**Wunde-Diagnose** wound diagnosis / **diagnostic wound**

**Verletzung** injury / **lésion**

**Verhewnung** burn / **brûlure**

**Kränkung** fracture / **fracture**

**Vergiftung** intoxication / **intoxication**

**Verstrahlung** radioactive radiation / **rayonnement radioactif**

**Psyche** psychiatric condition / **état psychiatrique**

<b>Zustand/Uhrzeit</b>		<b>Erst-Therapie</b>	
state/time		first therapy	
<b>Neuroleptika</b>	<b>n.B.</b>	<b>Infusion</b>	<input type="checkbox"/>
neuroleptics		infusion	
	<input type="checkbox"/>	<b>Analgetika</b>	<input type="checkbox"/>
	↓	analgesics	
<b>Atmung</b>	<b>n.B.</b>	<b>Antidote</b>	<input type="checkbox"/>
respiration		antidote	
	<input type="checkbox"/>		
	↓	<b>sonstige</b>	<input type="checkbox"/>
<b>Kreislauf</b>	<b>n.B.</b>	Medikamente	
circulation		other drugs	
	<input type="checkbox"/>	autres médicaments	
	↓		

**Bemerkungen** remarks / **remarques**

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back side

# Challenges Mass Casualty Incident

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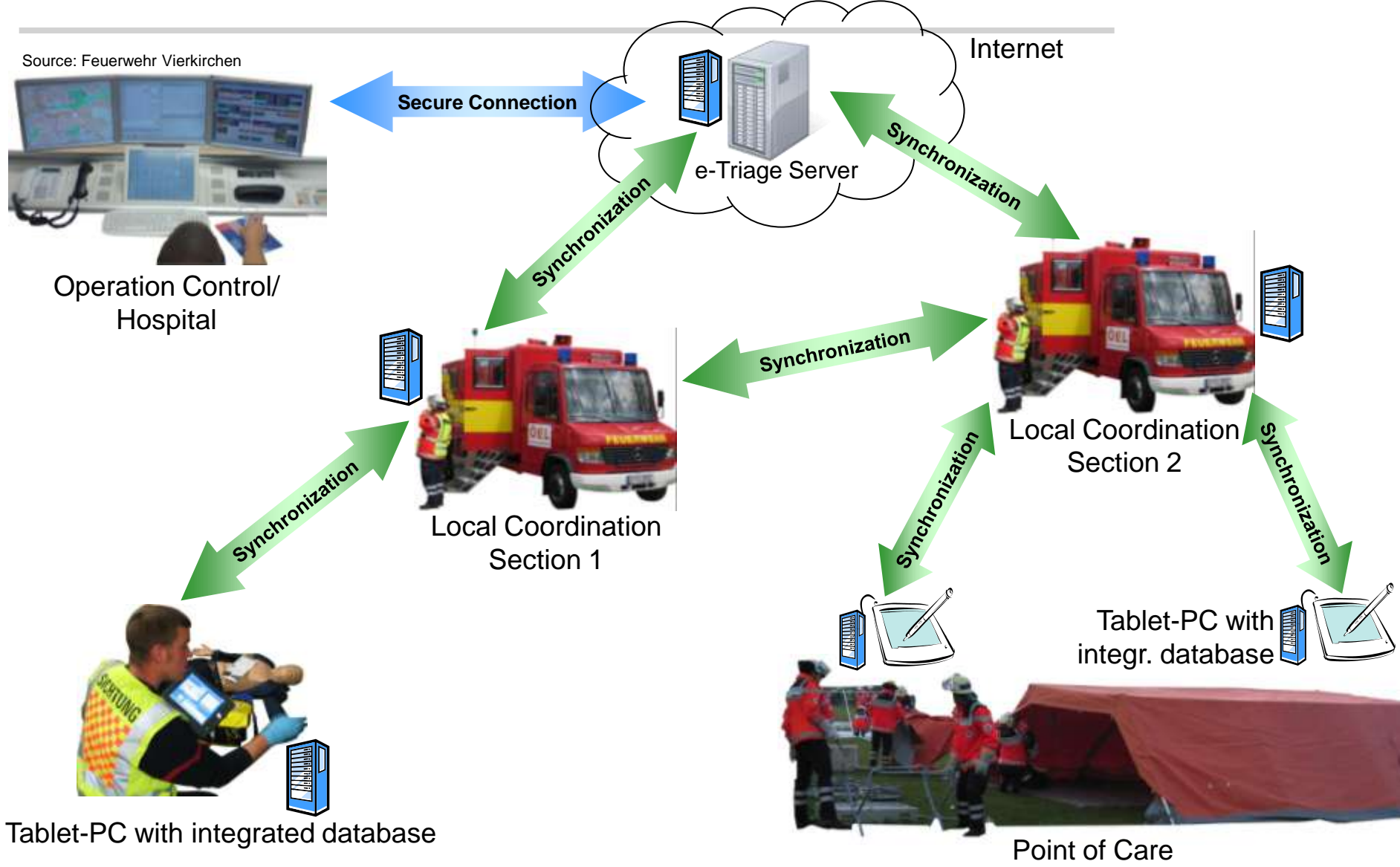
- **Possibly large-area situation**
- **Temporal development of situation:**
  - **Arriving rescue forces and operation control**
  - **Discovery and treatment of affected/injured persons**
- **Different organizations involved:**
  - **Manual merging of lists**
  - **Voice and paper as least common denominator**
- **Injured persons “bypassing” rescue chain**
- **Deferred situation overview for operation control**
- **Enormous stress for all involved persons:**
  - **Reduced cognitive capabilities**
  - **Consequence: usage of well-known devices (daily work)**

- **Tablet-PC** normally used for “**Notarzteinsatzprotokoll**” (standardized form emergency physicians have to fill in, aka “DIVI-Protokoll”)
- MCI: each victim gets **unique ID** (RFID/2D-barcode); Tablet-PC switched to simplified triage graphical user interface
- Acquisition of data with **Tablet-PC**: ID + triage result + GPS coord. + photo + ...
- Immediate or cached **wireless transmission** to operation control
- If required, self-sufficient communication system via **satellite**
- Psychological **acceptance** studies

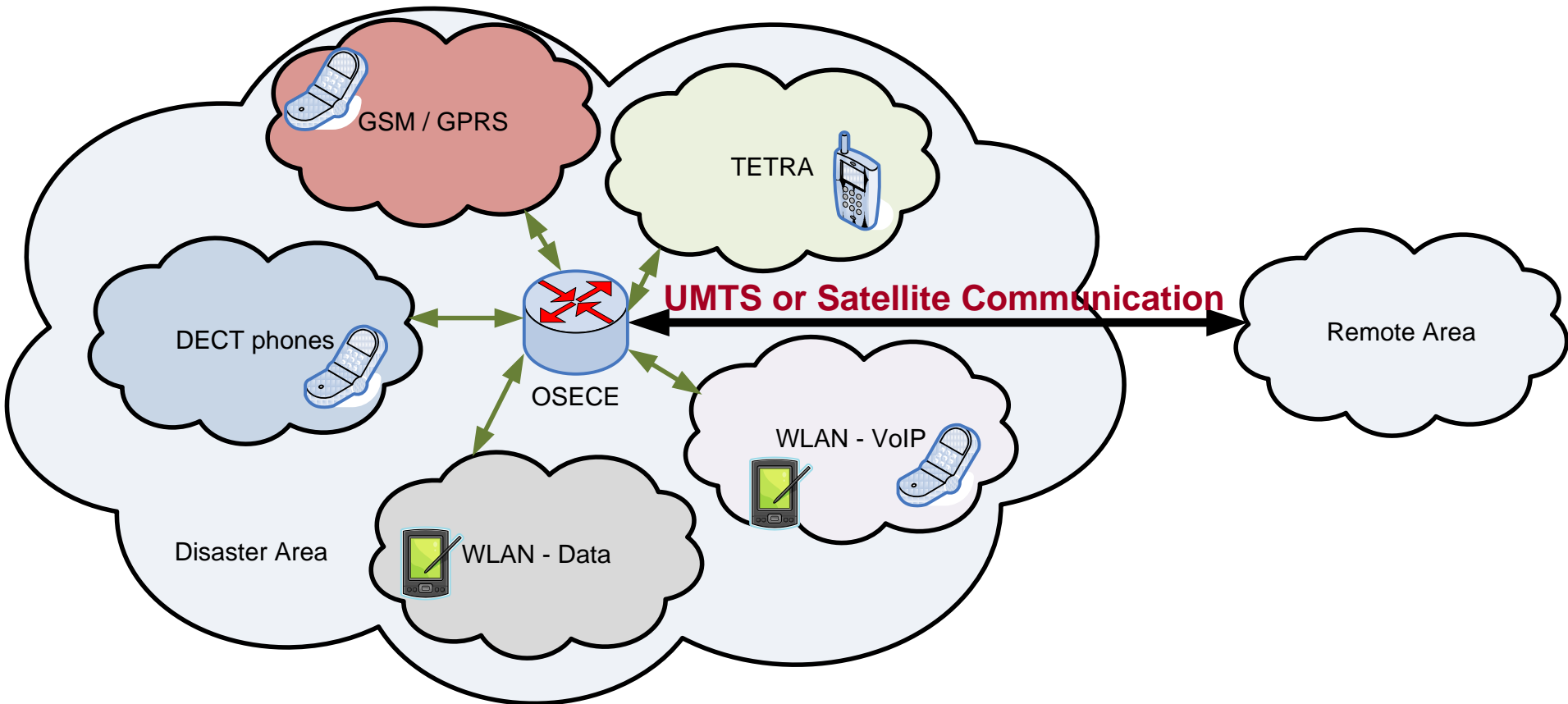
## Design decision: **Distributed Database System**

- Mobile (Tablet-PCs) and fixed (local operation control) nodes are instances of database system
- Network link interruptions as key design parameter of architecture
- Operation in heterogeneous data networks (narrow band, terrestrial, satellite)
- Efficient data replication/synchronization mechanisms coping with satellite link delay
- Self-configuring system: automatic route discovery, resource management, etc.

# e-Triage Data Management: Example Scenario



# Backhauling of Terrestrial Services



OSECE: On-site Emergency Communications Equipment



# e-Triage Satellite Communication Solution 1: Communication Suitcase



Battery



WLAN Router

GSM-Picocell



Fan



Inmarsat BGAN Terminal

Industrial-PC (with e-Triage database instance)

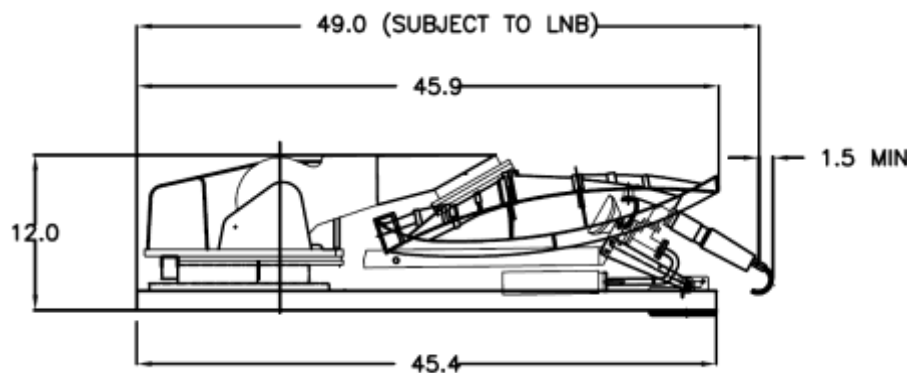
**Cell radius GSM: max. 300m**  
**Runtime (battery): ca. 2 hours**  
**Calls: max. 14**  
**World-wide usage possible**  
**(but regulatory limitations)**



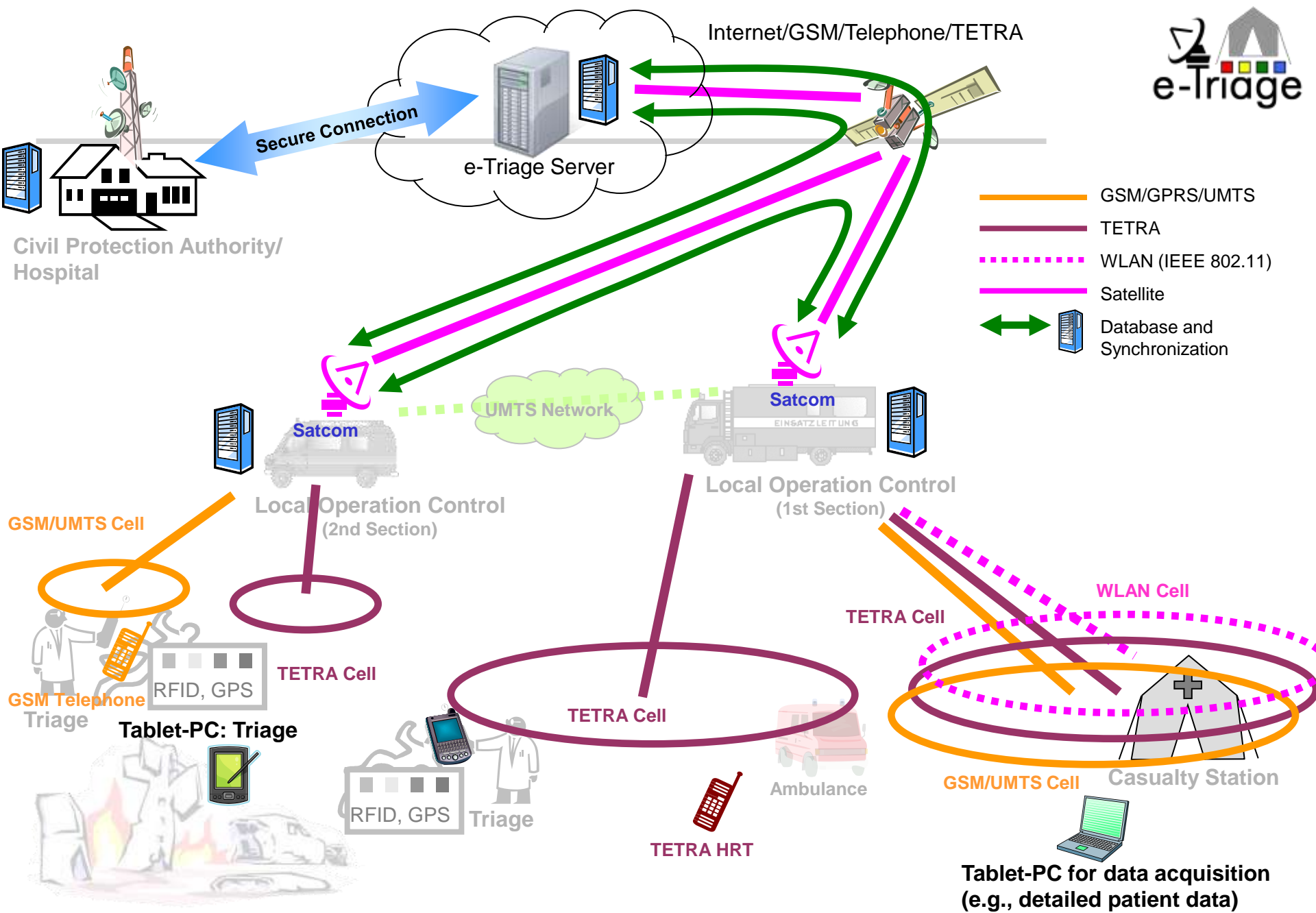
Source: TriaGnoSys GmbH

# e-Triage Satellite Communication Solution 2: Transportable Satellite Terminal

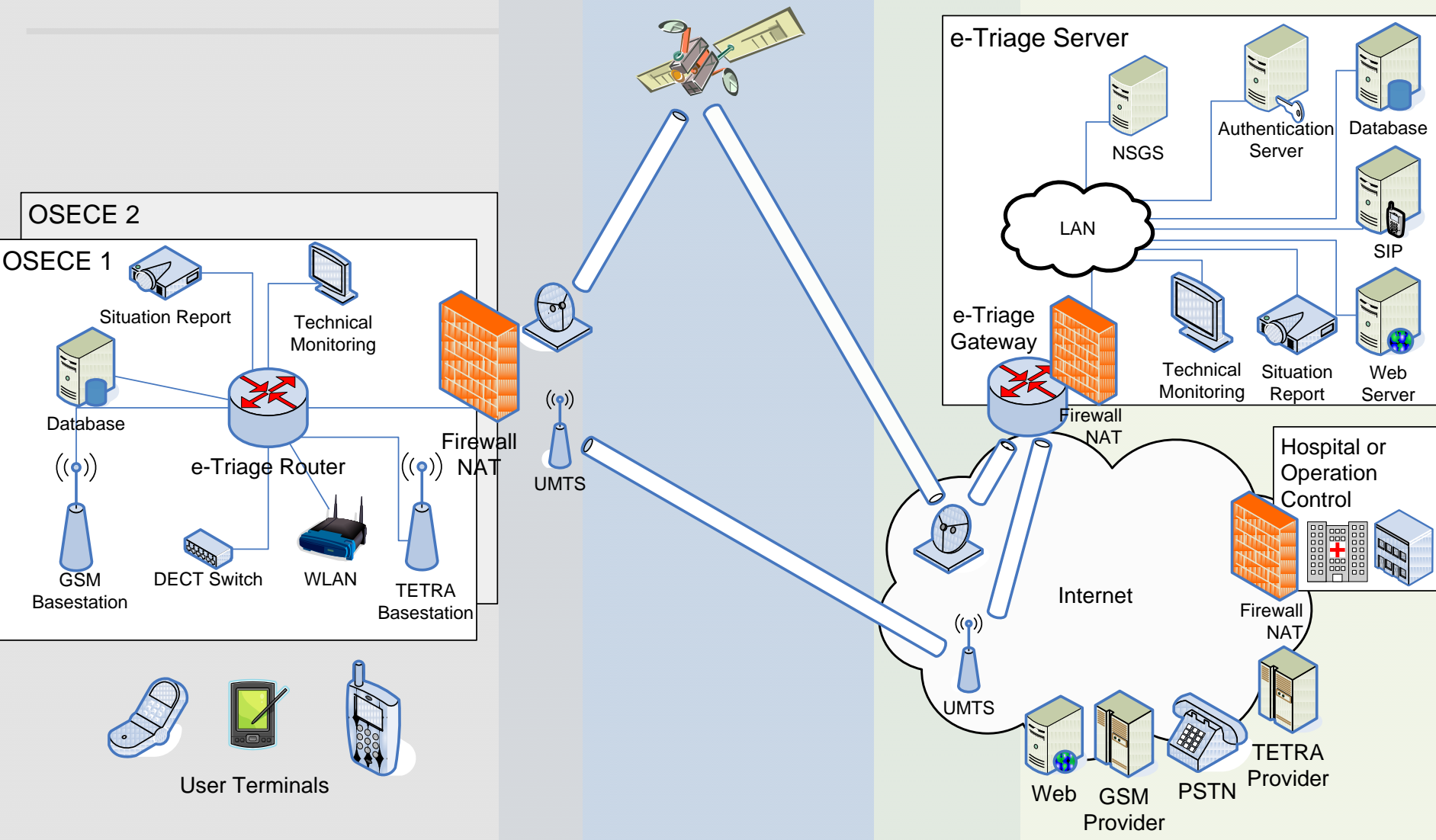
- Inmarsat BGAN terminal (part of communication suitcase) with limited data rates (typically 64-128 kbit/s)
- Broadband satellite communication with „bulky“ satellite terminal (similar DVB-RCS; e.g. 1 Mbit/s ← / 512 kbit/s →)
- Self-aligning satellite antenna (vehicle mount)



Source: [www.cobham.com](http://www.cobham.com)



# e-Triage Architecture



OSECE = On-site Emergency Communications Equipment

## e-Triage is a self-contained concept for electronic MCI management:

### ➤ **Data collection**

- ID + priority
- fully scalable up to form sheet for emergency physicians

### ➤ **Data management**

- Distributed, self-organizing, and self-synchronizing database system
- Same data basis for all decision makers at the same time
- Documentation (e.g., training, investigation, or CBRN scenarios)

### ➤ **Voice/data services**

- Backhauling of GSM (GPRS)
- Backhauling of DECT/VoIP

### ➤ **Satellite communication**

- Dynamic network extension
- No existing terrestrial infrastructure

- **First system trials in spring/summer 2011**
  - Invitation via *AG Verletztenversorgung der Plattform „Schutz und Rettung von Menschen“* (Projektträger VDI)
  - ... or indicate your interest by mail to [Anton.Donner@dlr.de](mailto:Anton.Donner@dlr.de)
  
- **Future challenges:**
  - Standardization of data fields and formats (!)
  - Frequency regulatory issues
  - Connecting databases of regular control centers with operation control in the field



World Class Standards

## ETSI Satellite Earth Stations (SES)

## Satellite Emergency Communications (SatEC) Current Work Items:

- **Multiple Alert Message Encapsulation over Satellite (MAMES)**  
DTS/SES-00310
  - MAMES is created to support, make flexible and ease the diffusion of alert messages from authorities and alert providers to citizens by a broadcast mode or a trunking mode.
- **Emergency Communication Cell over Satellite (ECCS)**  
DTR/SES-00313
  - ECCS deals with the set up of a temporary emergency communication cells (e.g., IEEE 802.11, VHF/UHF, IEEE 802.16, GSM or TETRA) which are then linked/backhauled to the permanent infrastructure by means of a bi-directional satellite link.



# Project Partners

## Coordinator:

- **Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)**  
Institute of Communications and Navigation

## Partners:

- **TriaGnoSys GmbH, Weßling**
- **Euro-DMS Ltd., Olching**
- **Ludwig Maximilian University of Munich, Psychology Department, Munich**

## Kindly supported by:

- **Bavarian Red Cross, Division Starnberg**  
Emergency Medical Services and Civil Protection
- **Trauma Center Murnau**  
Multi-regional Care Center
- **Starnberg District Office, Department Traffic Systems, Fire Safety and Disaster Control**  
Civil Protection Authority
- **Staatliche Feuerweherschule Geretsried**  
Public Fire Brigade School



<http://www.e-triage.de>