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New possibilities of GNSS systems in crisis situation

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GNSS

Basic applications

1. Military technologies

   - digital battlefield of the future
   - soldier of the future

2. Civil technologies

   - transport telematics
   - energy systems
   - security systems
   - smart agriculture
   - assistive technologies
   - telemedicine

3. Interdisciplinary technologies, atypical applications

   - crisis situations and solutions

GNSS

Crisis situations

1. Natural disasters

   - earthquake - flooding - space disasters
   - fires - meteorological effects - extraterrestrial contacts ☺

   (scope: local, medium, global ….)

2. Industrial accidents

   - nuclear disasters - chemical accidents

   (scope: local, medium, global ….)

3. Terrorist attacks

   - conventional attacks - nuclear attacks

   (residential areas, infrastructure, ground & air transport …)

   (scope: local, medium, global ….)

GNSS

Crisis solutions

1. Problem recognition

- emergency call
(national & international lines – e.g. 112, 155, …)

- automatic detection systems
(detection of fire, burglary, industrial)

- satellite detection & reporting
(infrared sensors, nuclear explosion detection, multispectrum recording and evaluation of Earth surface)

2. Localization

Initial localization = GNSS

- map

- smart map

- general GIS

3. Communications

- ground communication systems
- TV, PSTN, local radio, …
- mobile networks (GSM, UMTS, WiMax, …..

- satellite communications
- public (Iridium, GLOBALSTAR, Thuraya, ….), TV
- non-public (army, security and rescue forces)

4. Rescue operations

- local service

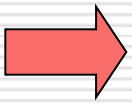
- integrated rescue service

Classification of actions

1. Professional (integrated) rescue service

2. Affected area and its population

Professional (integrated) rescue service

- Typical structure 
  - police
  - firefighters
  - medical rescue service
  - army
  - others

- **Identification of position and communication**
  within each team, among the teams and with the affected area are fundamental prerequisites

- Basic localization technique – GNSS – should be augmented by support for localization inside buildings and areas with no satellite signal. Same situation at all levels.

The objectives of the communication platform for crisis management are first of all

•Fast deployment of the communication infrastructure to be used by the rescue teams and crisis management staff;
•Assessment of the scope of the disaster, contamination, etc.;
•Coordination of team activities in the field;
•Communication with safe or foreign areas for coordination of humanitarian and security aid, etc.

One should assume that due to the disaster:

•Local communication infrastructure is damaged;
•Remaining communication networks are overloaded;
•External means of communication cannot be included into local networks in acceptably short time;
•Power blackouts occur.

The project consists of several parts

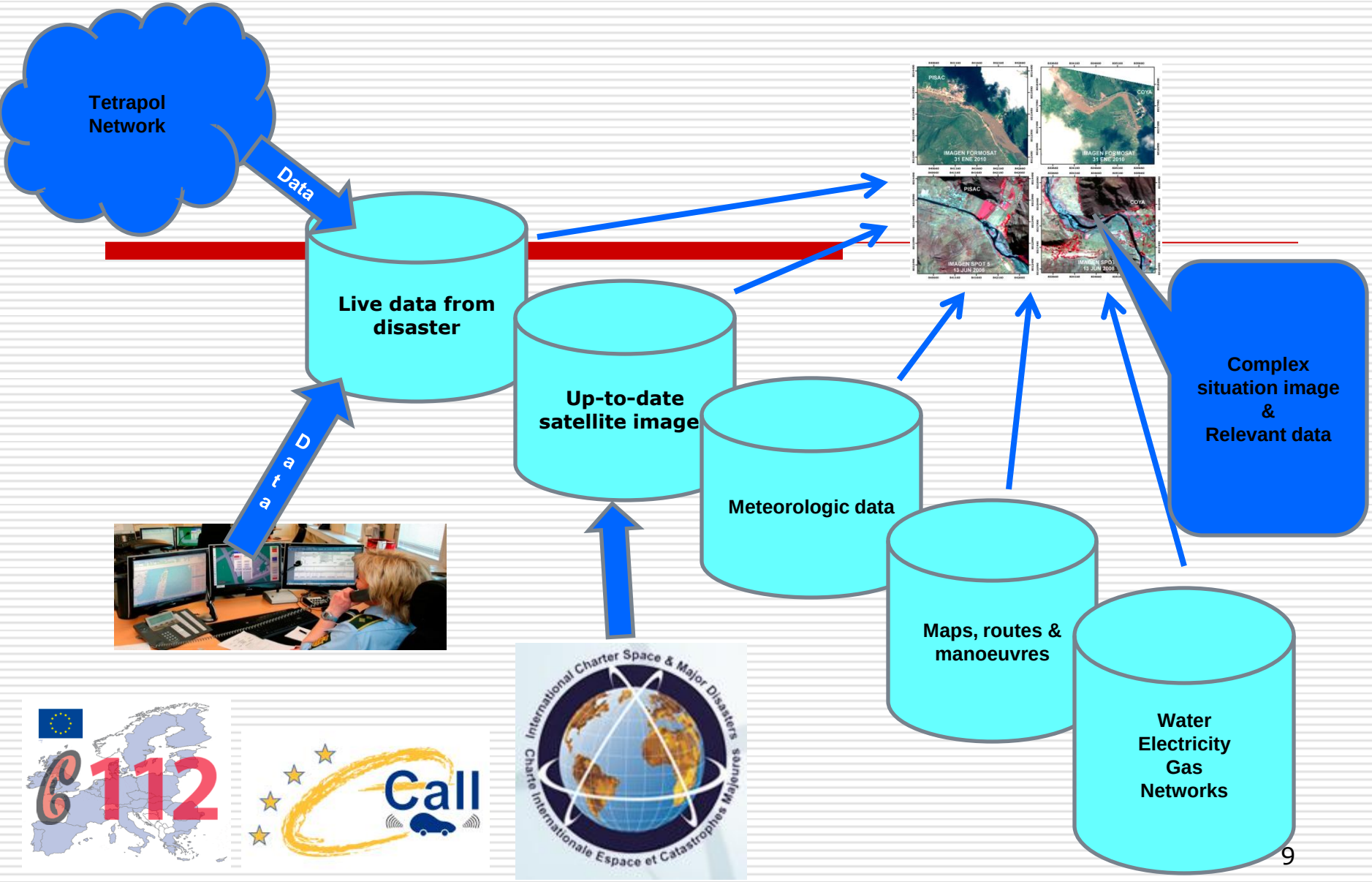
•System of field sensors for immediate monitoring of emergency situations (sensors placed on helicopters, airplanes and ground sensors);
•
•IT infrastructure including central databases, their management and basic interfaces for private and public networks;
•
•Production module for processing data from sensors and for their correlation with data from other sources. Situation model synthesis.

•Decision support module. It should suggest a solution for the situation and plan partial rescue operations based on the situation model obtained within the production module;

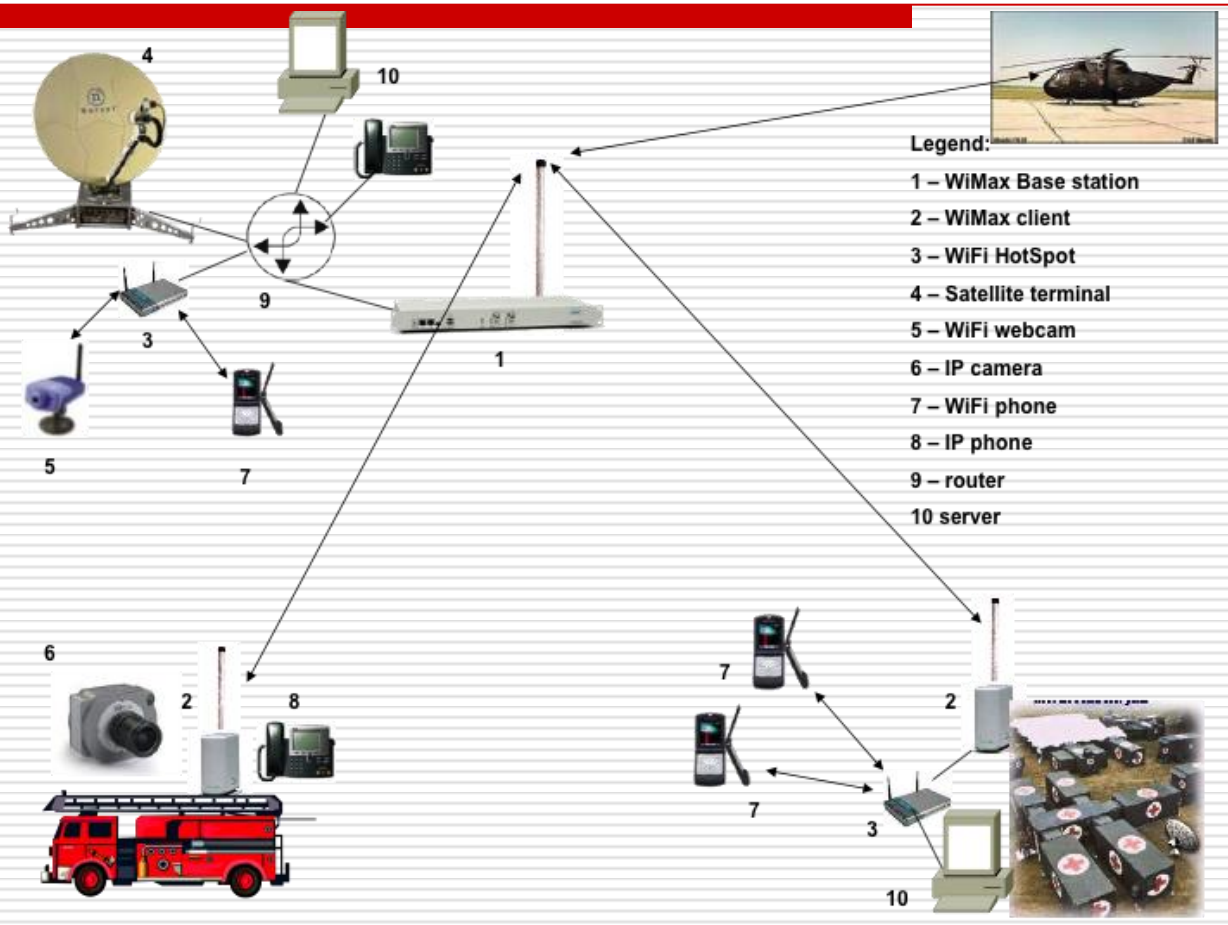
•Field telecommunication networks suitable for the most essential communication using Tetra and Tetrapol systems;

•Interface into GSM networks for area-wide broadcasting of alert SMS.

Integrated Emergency Center

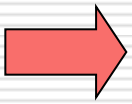


IP Communication system for emergency squads



Affected area and its population

- Basic problem



  - PSTN failed
  - cell phone network failed
  - no electric power
  - confused situation
  - low or no availability of information

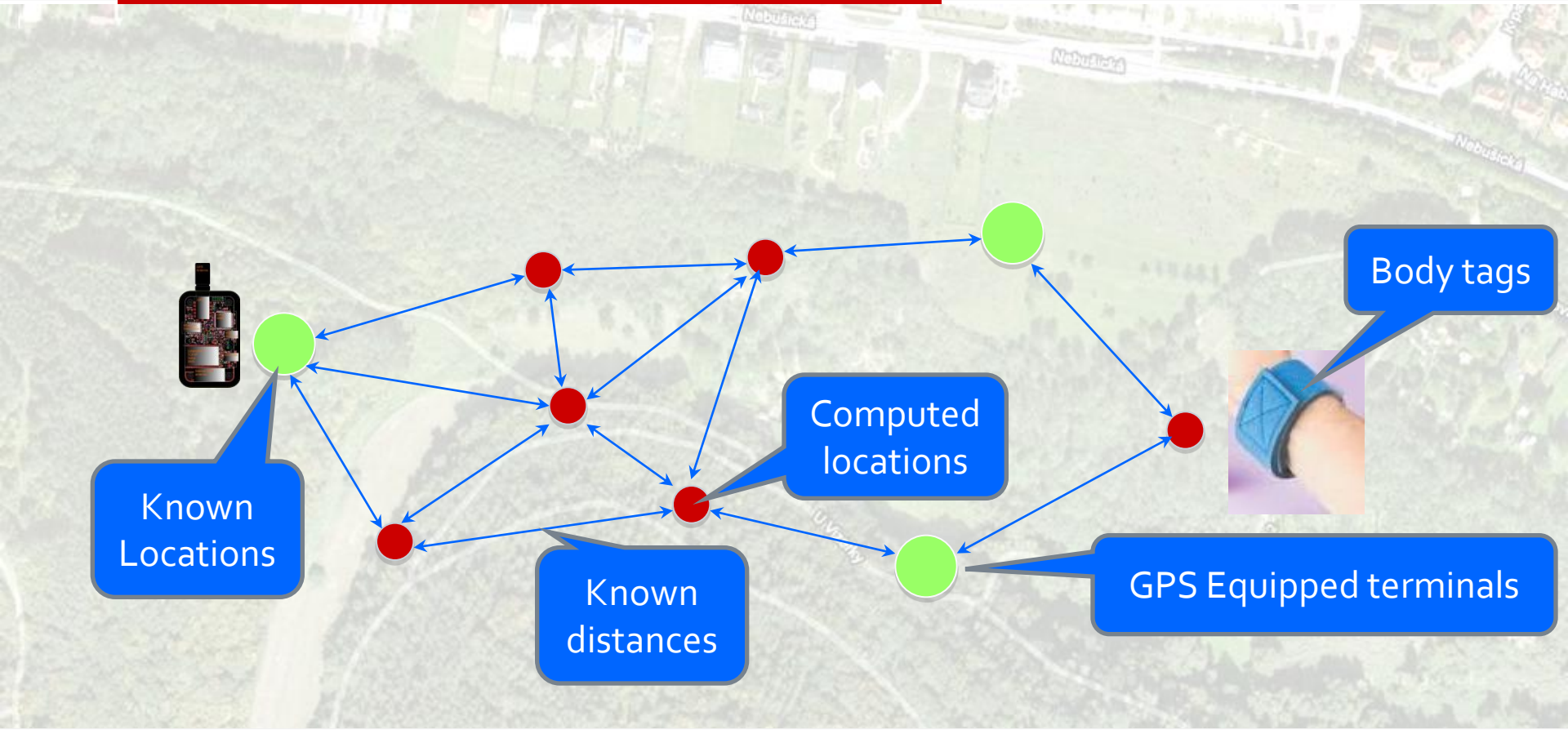
- Possible broadcasting of information during major disasters is limited to TV or radio usually, where battery remains often the only power source for the receivers.

  Current cell phones ease the situation a little, as they are able to operate as radio (and less frequently also as TV) receivers.

- Basic localization technique – GNSS – should be augmented by support for localization inside buildings and areas with no satellite signal. Same situation at all levels.

RescueRange-Disaster victim triage system

Node location is based on the computation of the relative distances of network components. Nodes are equipped with RFID 802.15.4 chips
To compute location of nodes on the real map, system needs at least three nodes with known location, either fixed or mobile, equipped with GPS.



InterLink – a possible solution

- Optional component designed to distribute high-volume data such as maps and satellite images to field terminals.
- Consists of two different network technologies available on terminals WiFi and WiMax

WiMAX field terminals

WiMAX base on mobile platform

UpLink

DVB-RCS/S2 Satellite network

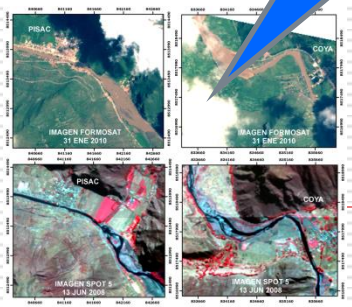
DVB-RCS/S2 WiMAX relay on mobile platform

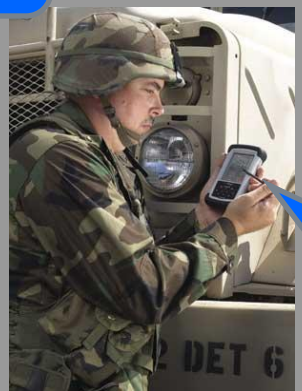
DVB-RCS/S2 Coverage

Data Link

FieldLink & InterLink

Complex data





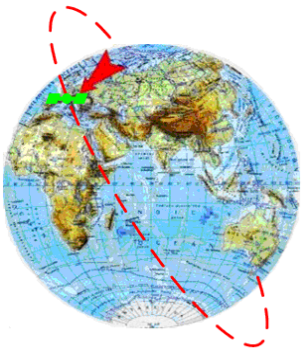
Handheld terminal

Affected area and its population – unconvential and innovative solutiuons

- UMTS–S, DVB-SH ……. Not yet implemented(2011)
- DVB-SH ..... USA 2010, EU 2011
- LTE ..... USA 2011, EU, 2012
- SPEROS ……. Legal obstacles

Affected area and its population – unconvential and innovative solutiuons

SPEROS (*SP*ace *E*uropean *R*esearch *O*rbital *S*tation)



Project proposal submitted to ESA

Principal objective

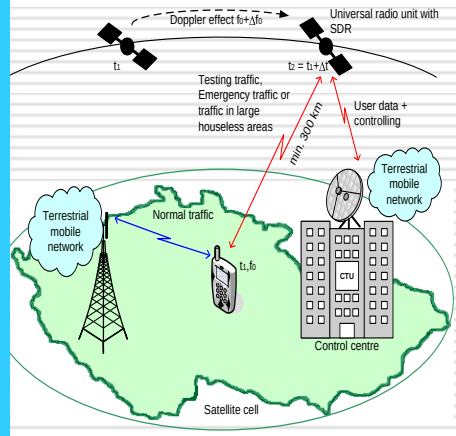
- Develop a universal radio unit moving on Low Earth Orbit (LEO)
- Remotely implement and support a wide spectrum of telecommunication applications (current and future ones) aboard a satellite, programming the unit adequately
- Build a cosmic GSM cell using standard GSM mobile terminals (phones) or a UMTS-S alternative
- From the basic and applied research to practical deployment in large (uninhabited) areas or in cases of emergency (breakdown of BTS/BSC networks, floods, earthquake, ...)

Based on SDR

- Software-Defined Radio technology
- Innovative approach to the development and testing in wireless telecommunications → current and future telecommunication technologies implemented remotely, only by software changes in the SDR module

Conclusion:

- Communication using either UMTS-S or GSM systém
- Placement -- ideally as one of transponders carried by a navigation satellite



Thank you for your attention!