AirMonTech Workshop – Duisburg, GER

Live Geography

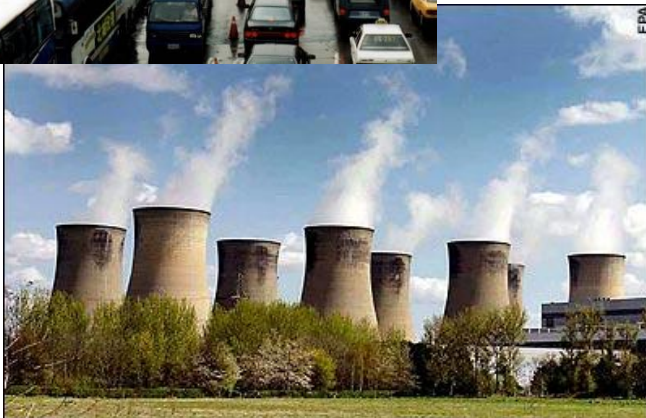## A Puzzling Exercise: Network Data Assimilation Combining Different Sources of AQ Data

RUPRECHT-KARLS-
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Bernd Resch

04 March 2013

Real-time Air Quality Monitoring?

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A Puzzling Exercise: Network Data Assimilation Combining Different Sources of AQ Data

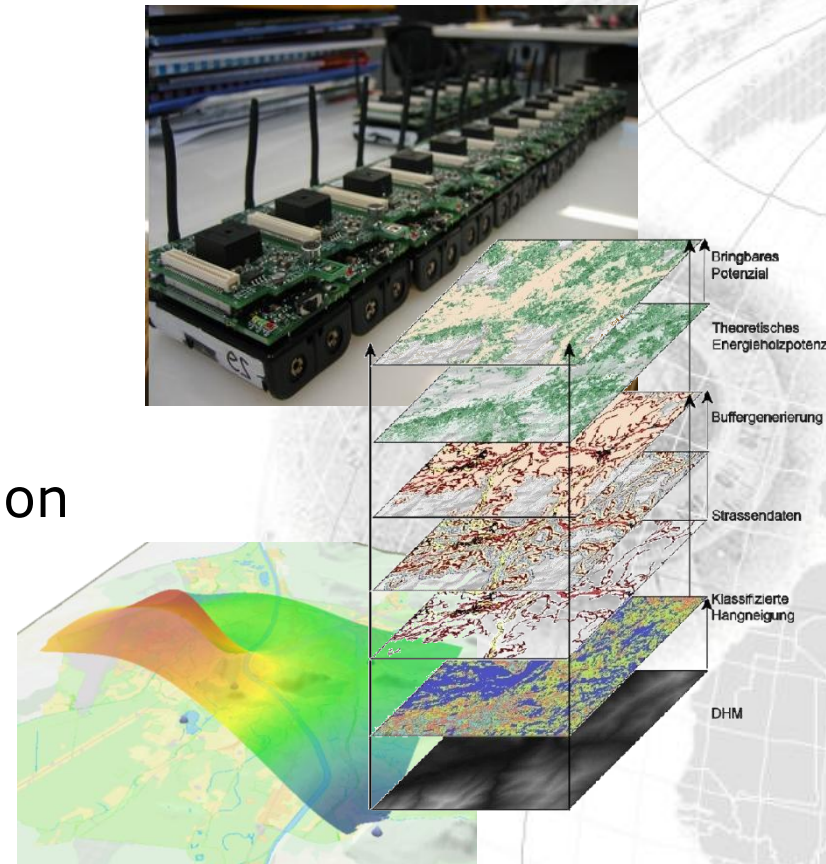RUPRECHT-KARLS-
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Overview

- Live Geography

  - Standardisation

  - People as Sensors

  - Scale-Dependent Sensor Fusion

  - Quality Assurance + Privacy

 - Examples

Live Geography ::: Vision

- "In the next century, **planet Earth will don an electronic skin**. It will use the Internet as a scaffold to support and transmit its sensations. […] It consists of millions of **embedded electronic measuring devices**: thermostats, pressure gauges, pollution detectors, cameras, microphones, glucose sensors, EKGs, electroencephalographs. These will probe and **monitor cities** and endangered species, the atmosphere, our ships, highways and fleets of trucks, our conversations, our bodies – even our dreams."

(Neil Gross, 1999)

Live Geography ::: Infrastructure

- Flexible and portable monitoring infrastructure

→ Standardisation enables a wide variety of monitoring applications

→ Sensor systems: not only view and analyse the world, but influence it in real-time
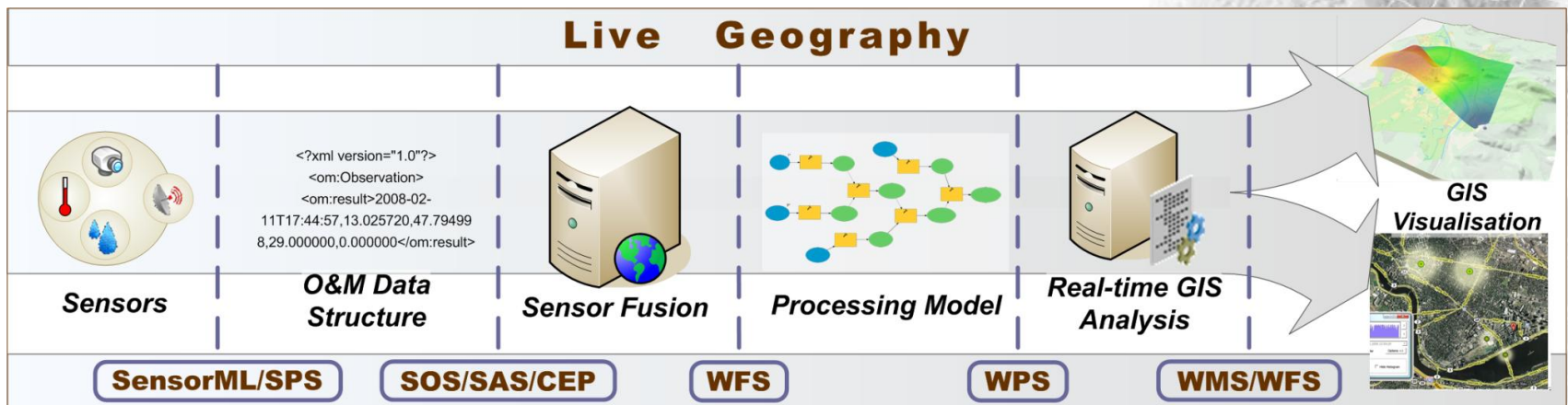
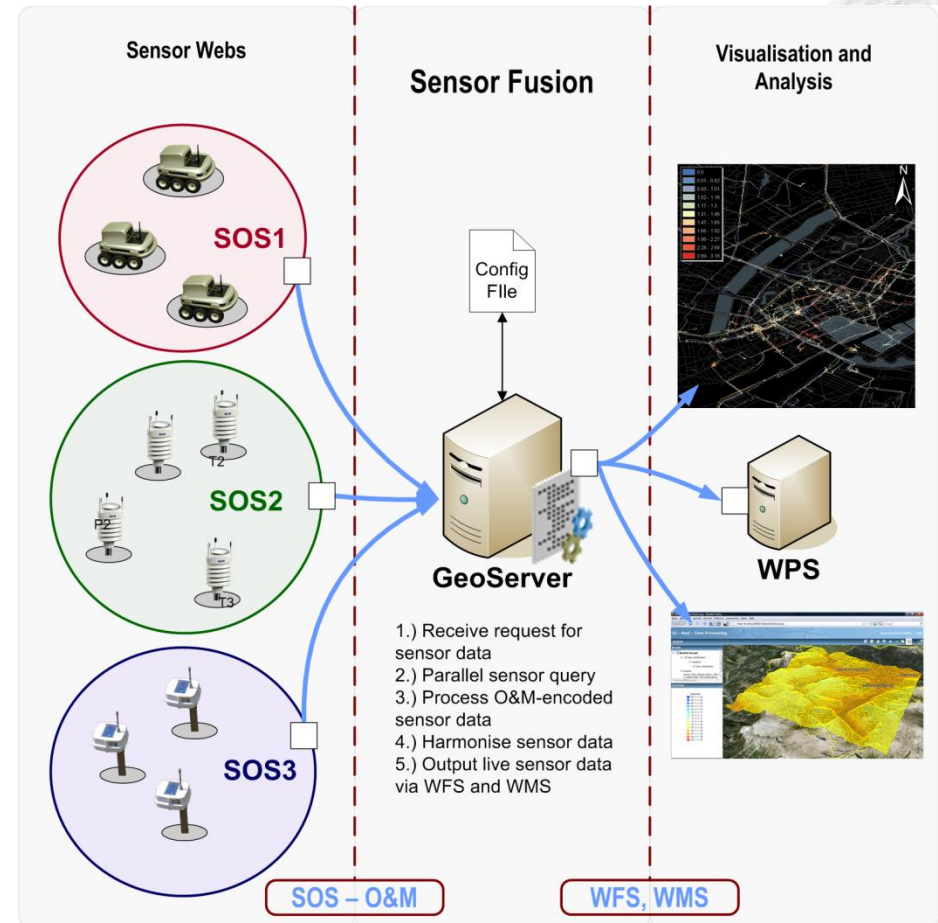# Live Geography ::: Scale-dependent Data Aggregation/Fusion

- Temporal resolution

- Spatial resolution

- Units of measure

- Coordinate Reference Systems

- Time zones

- Spatial and temporal aggregation

- ...
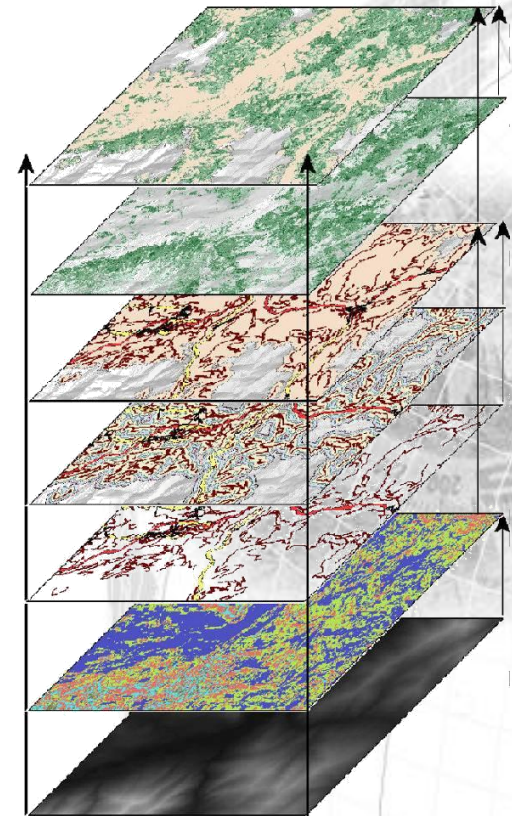
Live Geography ::: Data/Sensor Fusion

- Real-time harmonisation

- On-the-fly integration

- Standardised provision
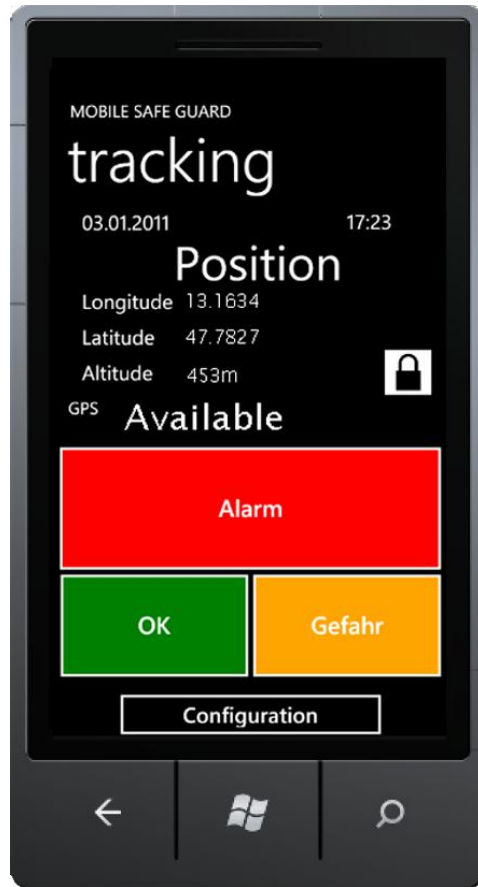
- Analysis in near real time

Live Geography ::: People as Sensors

- **People as Sensors** – Citizens as Sensors, Humans as Sensors, Human Sensors

- Collective Sensing

- Citizen Science

➔ VGI – Volunteered Geographic Information
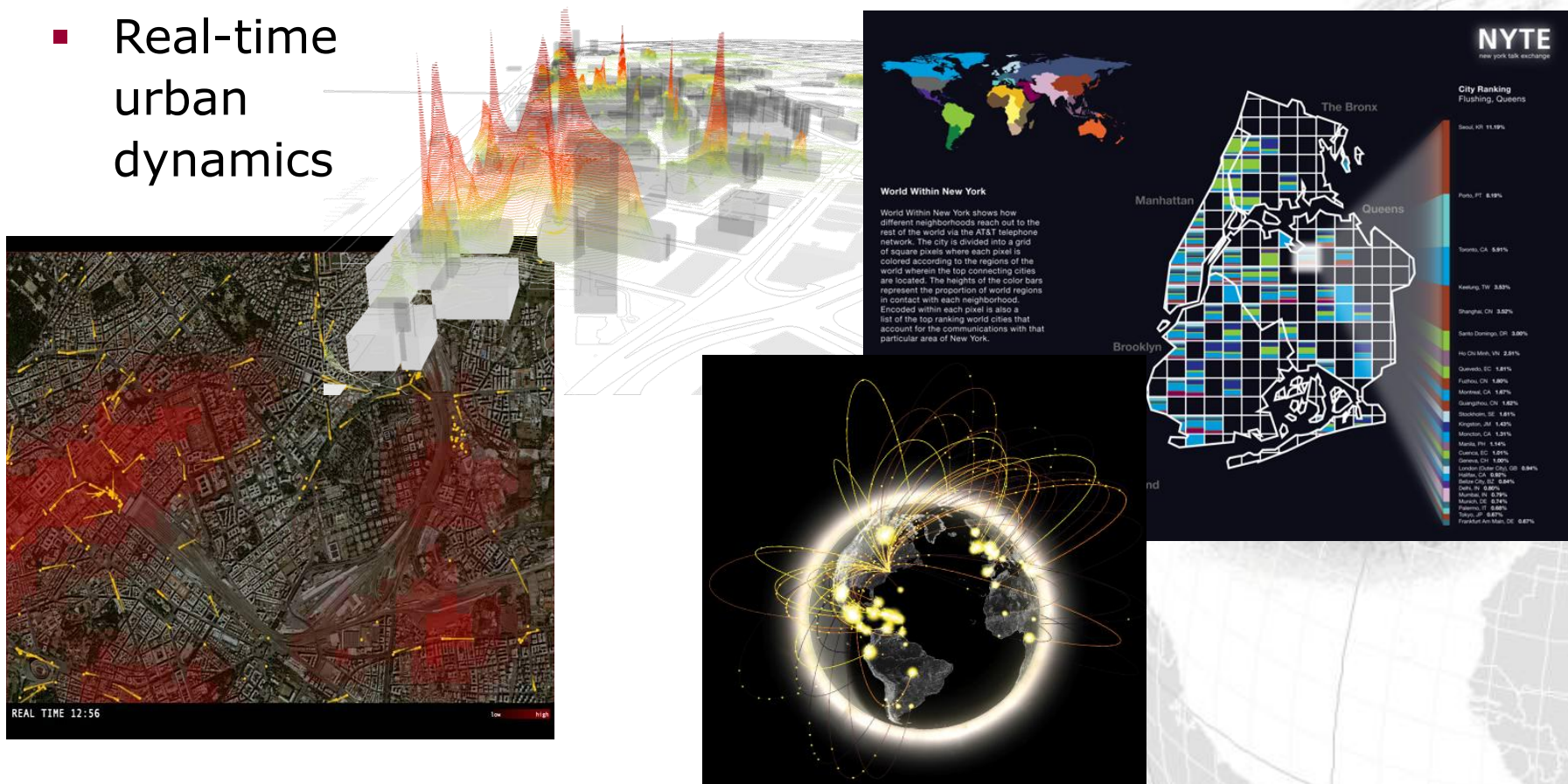 UGC – User-generated Content
  Crowd-sourcing

Live Geography ::: People as Sensors

- Simple, intuitive design

- Pre-defined categories

- Status adaptable to application context

- Configuration interface

- Tracking mode possible

Live Geography ::: Collective Sensing

- Real-time urban dynamics

Live Geography ::: Quality Assurance

- Open issues in semi-automated quality assurance:

  - Establishment of formalised rule sets

  - Methodological agreements → classes, categories

  - Integration into data structures → UncertML?

  - Event detection mechanisms → CEP?

  - Push-based data transmission → SAS/SES, CAP?

Live Geography ::: Privacy
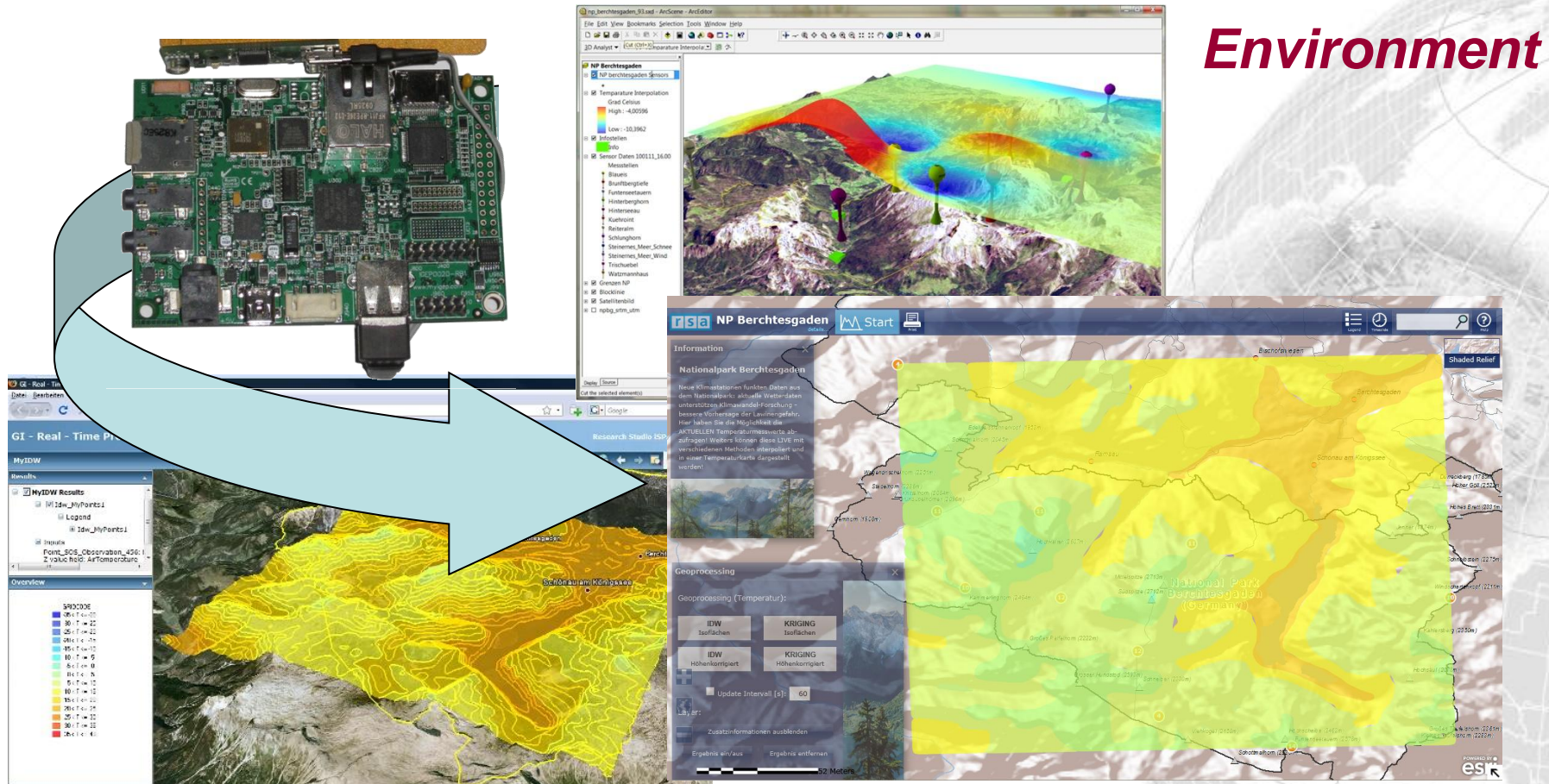
- **Privacy and Legislation Measures**

  - ◆ Research outputs are oftentimes only surrogates (!)

  - ➜ "Appropriate" granularity level

  - ➜ Legal frameworks!
    Data ownership?
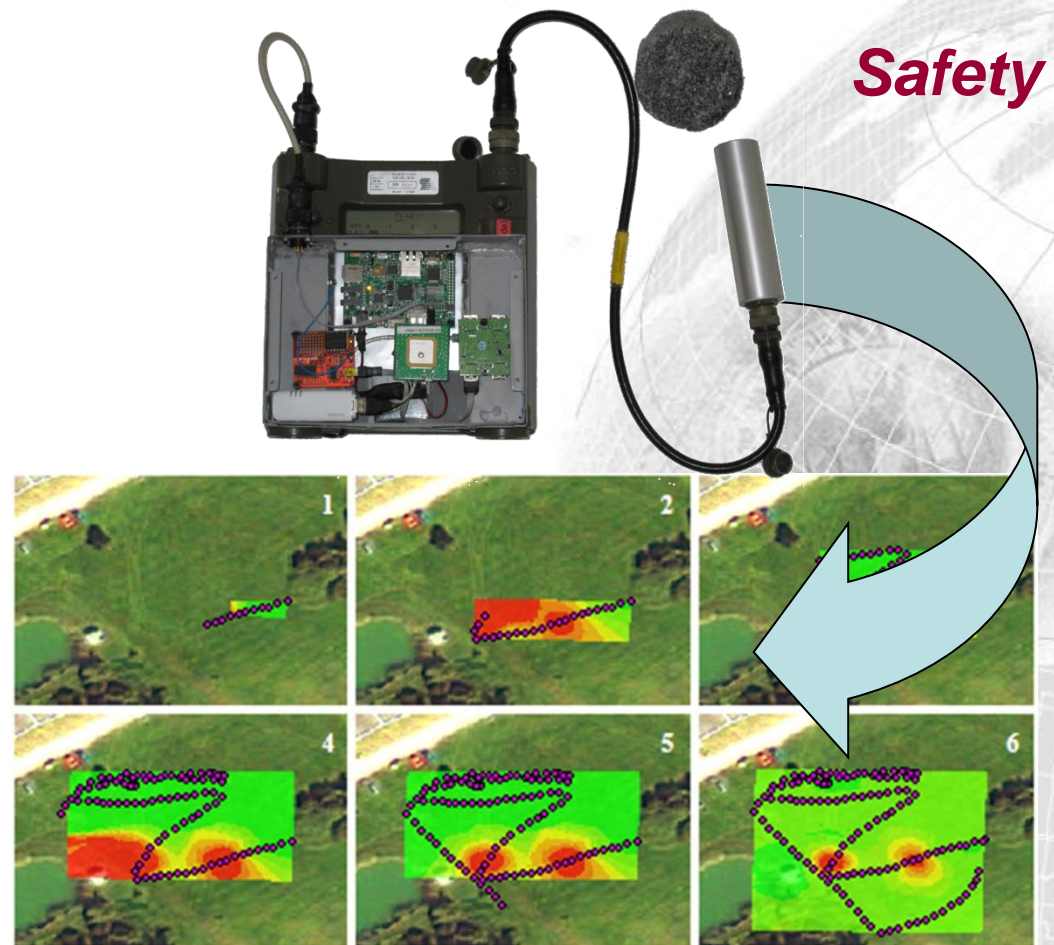   Data storage?
    Liability?

Sample Applications

Live Geography ::: Real-time GI

Environment

Live Geography ::: Real-time GI

Safety

- Detection of radiation sources

- Galileo und DGPS integration

- Real-time 4D analysis

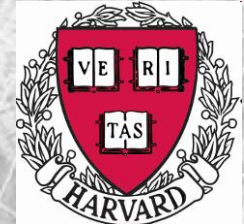➜ Establishment of a "Situational Awareness"
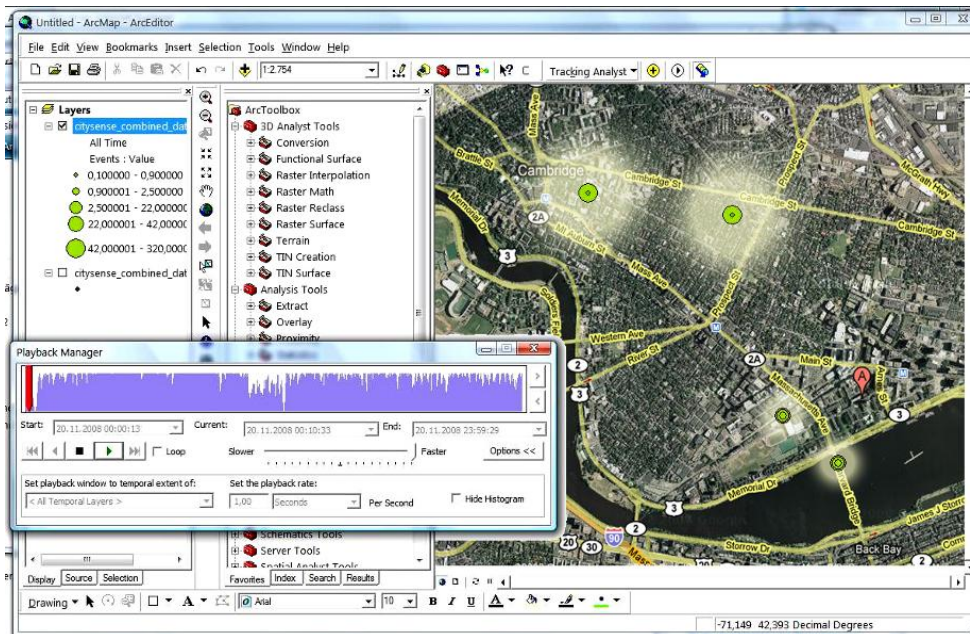
Live Geography ::: Real-time GI

- **Goal:** Realisation of „Pervasive Sensing" in the urban context

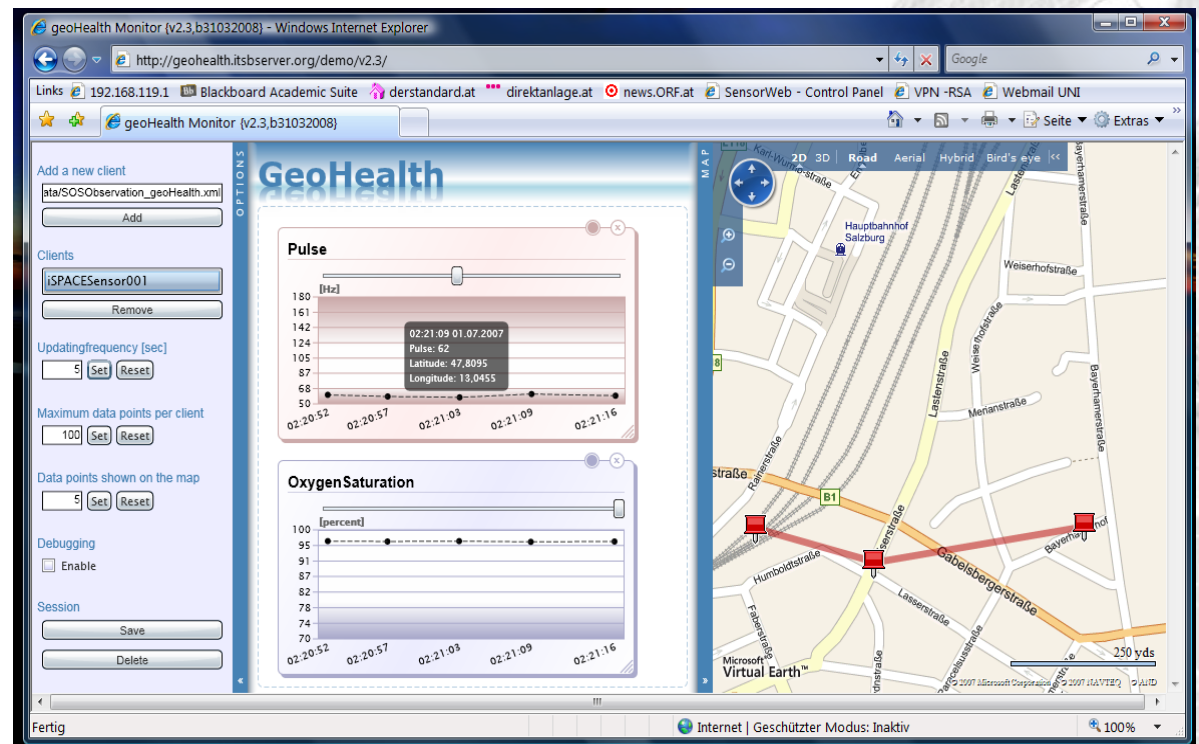- **Result:** Time series visualisation of air quality measurements and impact assessment for public health

Health

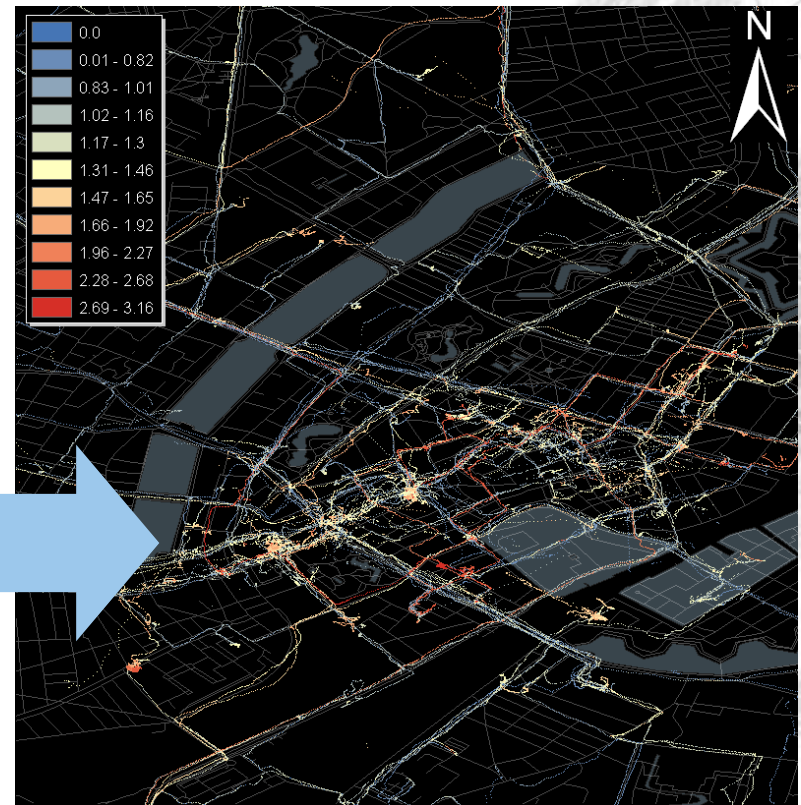# Live Geography ::: Real-time GI

Health

- Biometric monitoring

- Pervasive health parameter surveillance

Live Geography ::: Real-time GI

Air Quality

- Ubiquitous mobile sensing

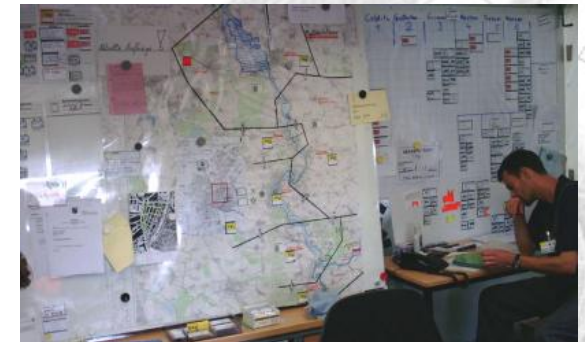- City-wide air quality

Final Claim

Live Geography ::: Conclusion

- Infrastructure-oriented instead of application-centred development

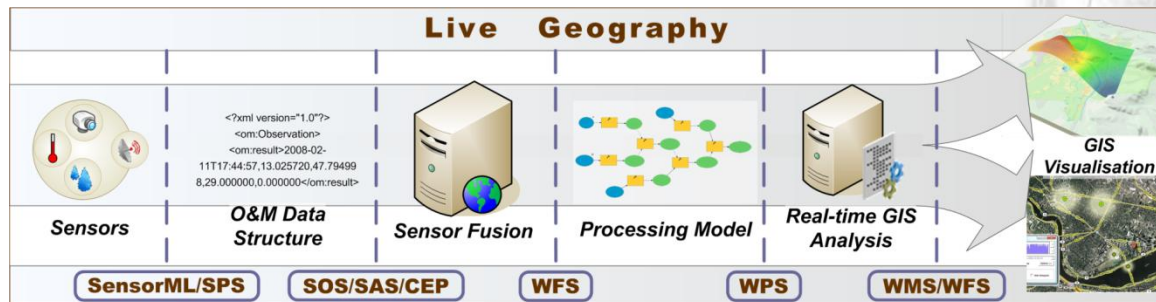 ➔ **Flexibility und portability**

- "Paradigm Change" in AQ developments

  - (Near) real-time workflows

  - Cross-integration of existing systems

➔ **Standardised real-time information systems**

Live Geography ::: Collaboration

Collaboration

- Air quality measurement analysis

  - Air quality impacts on insurance, real-estate, ... + traffic

  - Urban dispersion modelling

- Spatial Data Infrastructure (SDI)

- Environmental/spatial factors of AQ/health (CEP?)

  - Information system (Web-based analysis, mapping, SMS, …)

- Data quality + People as Sensors

→ **Collaboration with Harvard and MIT**

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