



# Integration of Sensors into Geodata Harmonisation Scenarios in the HUMBOLDT Project

ISPRS Geosensor Networks Workshop, Hannover, Germany

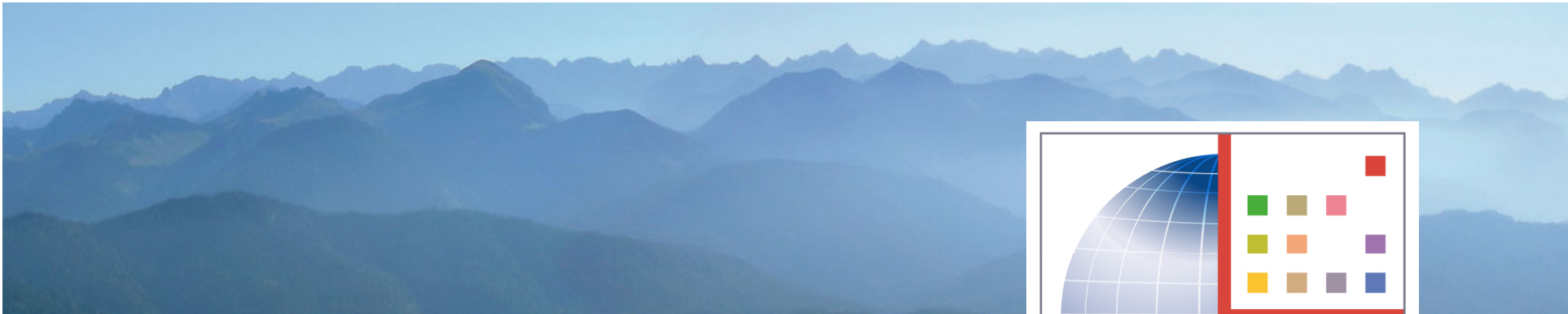
22.02.2008

Thorsten Reitz

Fraunhofer Institute for Computer Graphics Research IGD, Darmstadt, Germany

## Agenda

- ▣ The HUMBOLDT Project – Overview
- ▣ The HUMBOLDT Project – Approach
- ▣ HUMBOLDT Scenarios: Ocean, Border Security and others



# Introducing HUMBOLDT



## HUMBOLDT – Facts

Full title	<i>Development of a framework for data harmonisation and service integration</i>
Term	48 months 01/10/2006 – 30/09/2010
Effort	~ 13.5 mill. € (~50% self funded) ~ 110 person years
Contracting authority	Commission of the European Community FP6 – Aeronautics and Space (GMES)
Consortium	27 partners (coordinator Fraunhofer IGD)



## HUMBOLDT - Leitmotif



*It was the ultimate ambition of Alexander v. Humboldt to collect and integrate the knowledge of his time and, by doing this, to gain new insights in all areas of life.*

A step towards the European Spatial Data Infrastructure (ESDI)

Project philosophy:

**re-use the existing** – extend by need – arrive at the  
ESDI – prosper by application

 **HUMBOLDT – Vision**

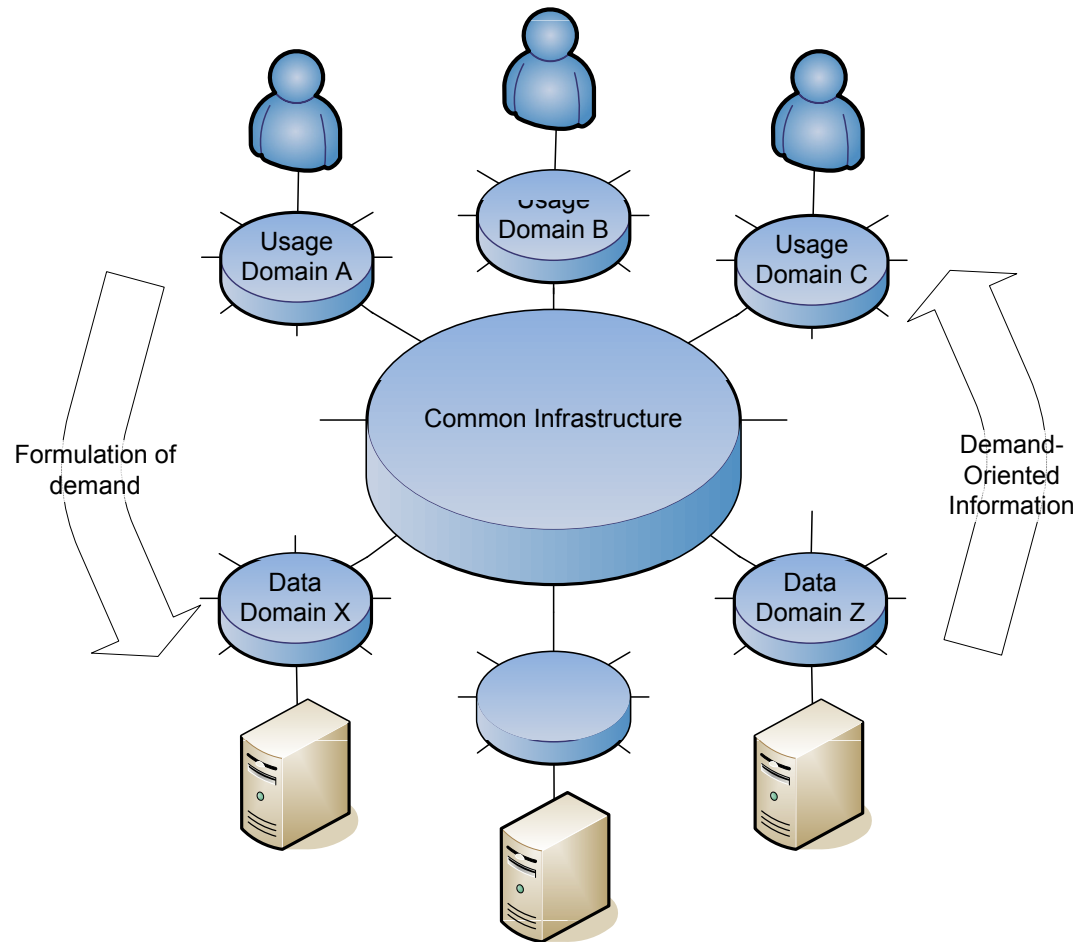
Trans-

sectoral

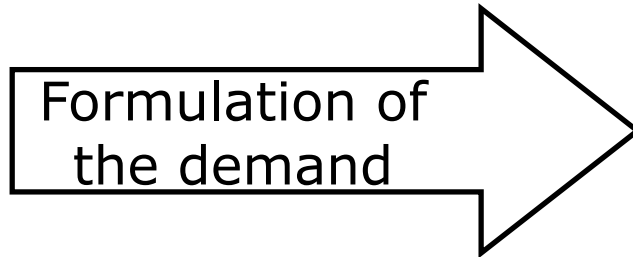
lingual

border

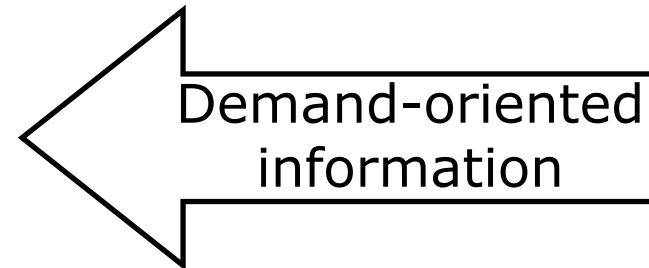
use of information



## HUMBOLDT – Vision (II)



- ▣ Format
- ▣ Spatial reference
- ▣ Graphical form
- ▣ Object generation
- ▣ Language
- ▣ Object semantics
- ▣ Model, attributes, semantics, ...
  
- ▣ Expected quality



- ▣ Provision of information in the language area / semantics of the application domain  
→ Information for user directly useable
  
- ▣ Quality information / information about the level of goal achievement  
→ Influences of the harmonisation processes on the quality

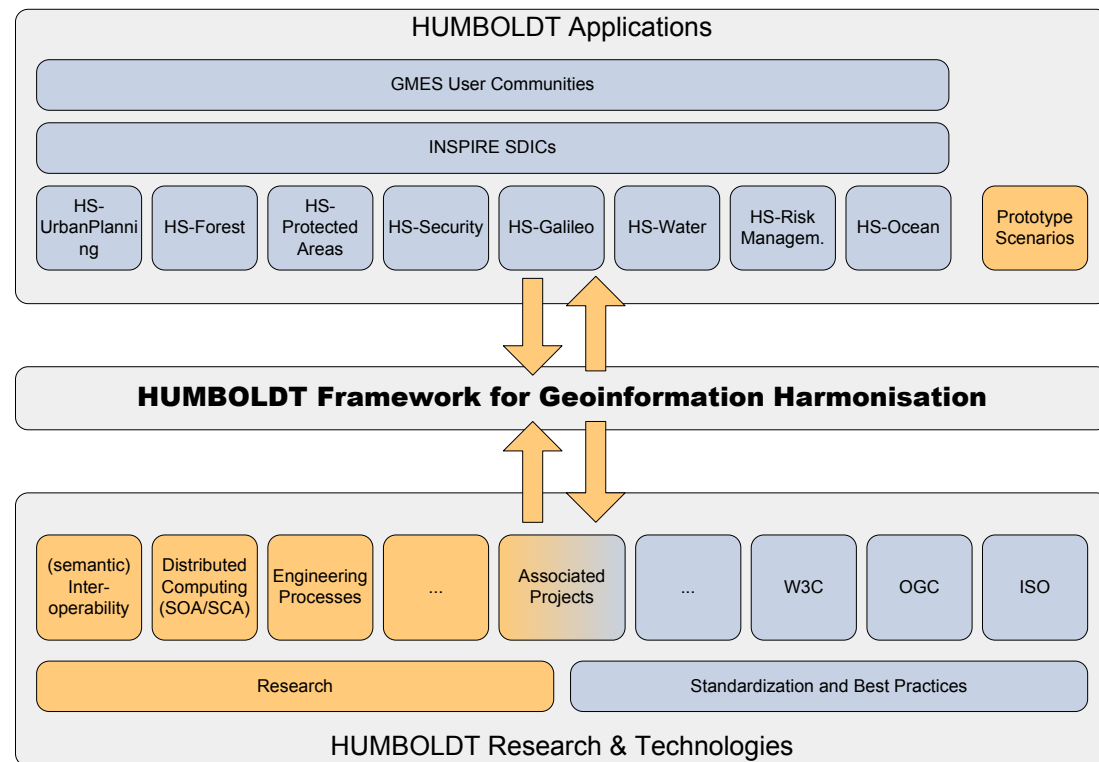
## HUMBOLDT - Approach

### Application-driven Approach

- ▣ Identification of user requirements (incl. “communication skills”)
- ▣ Proof of concept in different domains (scenarios)
- ▣ Evaluation as to user requirements

### Technology-driven Approach

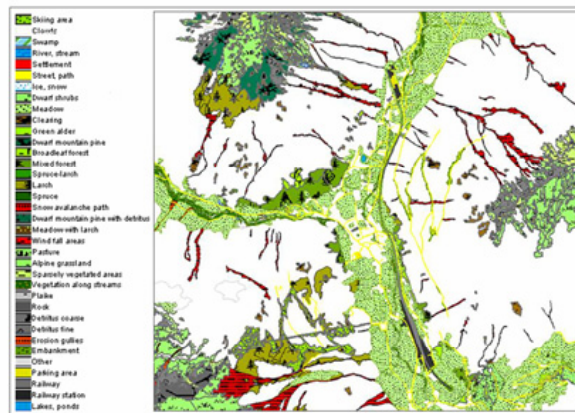
- ▣ Technical concept, implementation, and technical evaluation of the harmonisation framework
- ▣ Contributions and use of standards (OGC, W3C)



## Implementation in Scenario Applications



Tackling the Alpine Convention – Multi-Scale Monitoring of the Alps



### List of Scenarios

- ▣ HS-Border Security      HS-ERiskA
- ▣ HS-Urban Planning      HS-Water
- ▣ HS-Forest      HS-Ocean
- ▣ HS-Protected Areas      HS-Galileo
- ▣ → Further scenarios are planned

Applies to each scenario :

- Implementation of an end user application using harmonised data
- Evaluation against user requirements
- Demonstrator

## Selected Project results

- ▣ “HUMBOLDT Open Source framework“
  - Collection of tools, components and service implementations supporting the harmonization of various types of geodata
  
- ▣ “HUMBOLDT Applications“
  - Scenarios which make use of the HUMBOLDT framework to integrate data sets from various sources and give real-life demonstrations of it's capabilities
  
- ▣ Contributions to standards
  - Contributions to the development of the geoinformation market as a whole

## Project Results: What is the HUMBOLDT Framework?

- Collection of tools for harmonisation of existing spatial data and services with a level of automation as high as possible
  - **Software Tools** for defining and exploring the relations between heterogeneous sets of geodata
  - **Service Components** for the automatic transformation/translation of this geodata from one logical, physical and conceptual schema to one required for a task at hand
  - **Concepts** for establishing a Spatial data Infrastructure in Europe, based on INSPIRE IRs

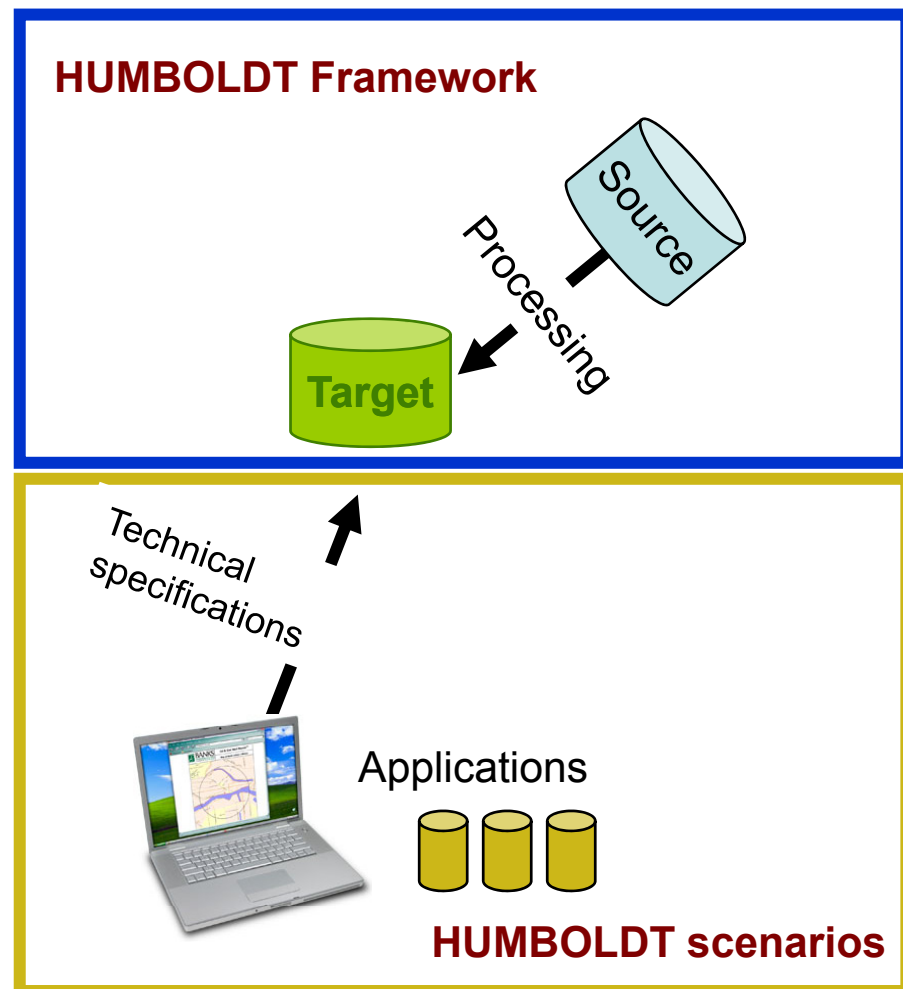
## What is the HUMBOLDT Framework?

### “framework for the technical process”

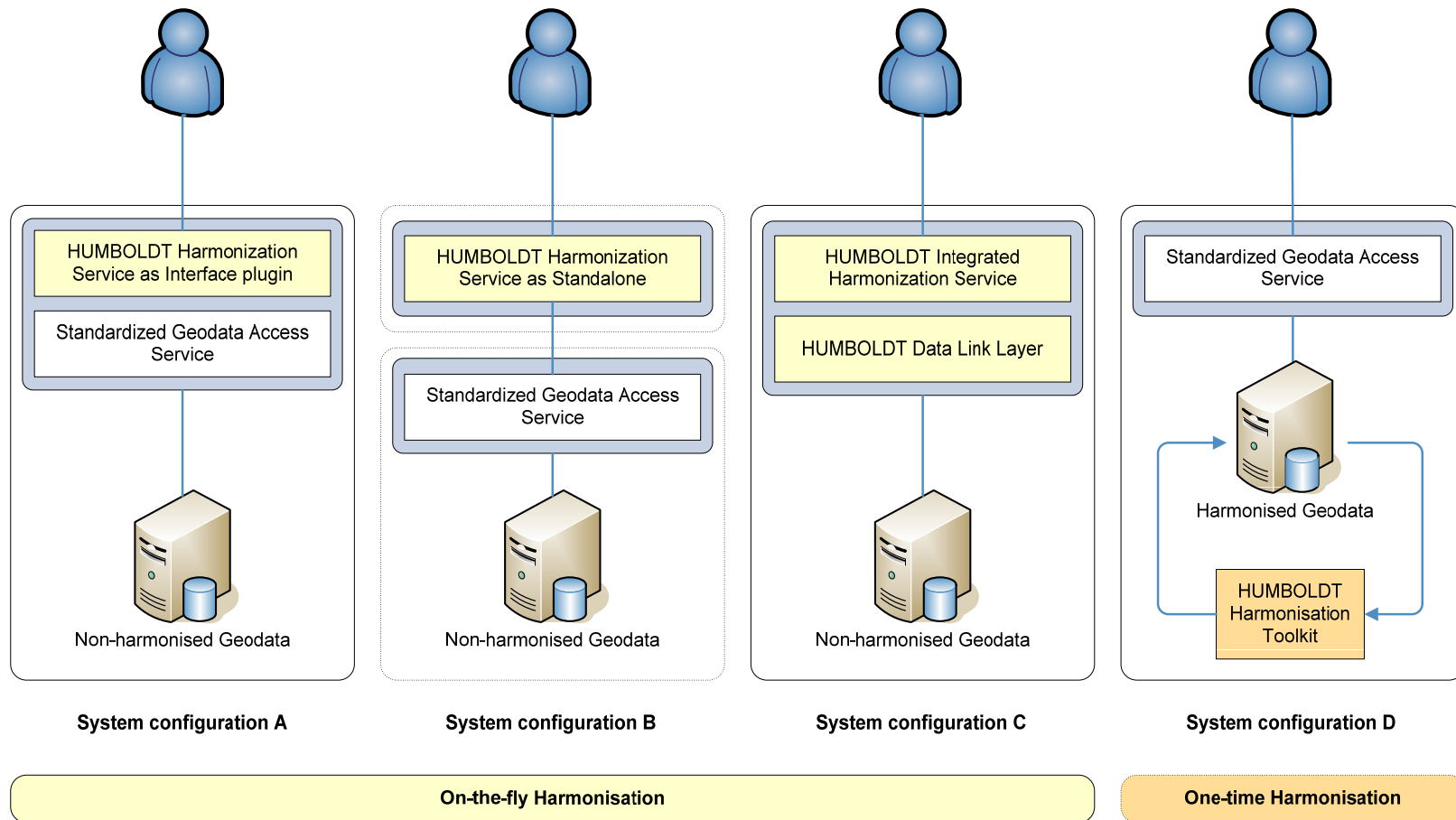
- Usage of mappings and catalogues
- Data and Service Integration/Harmonization

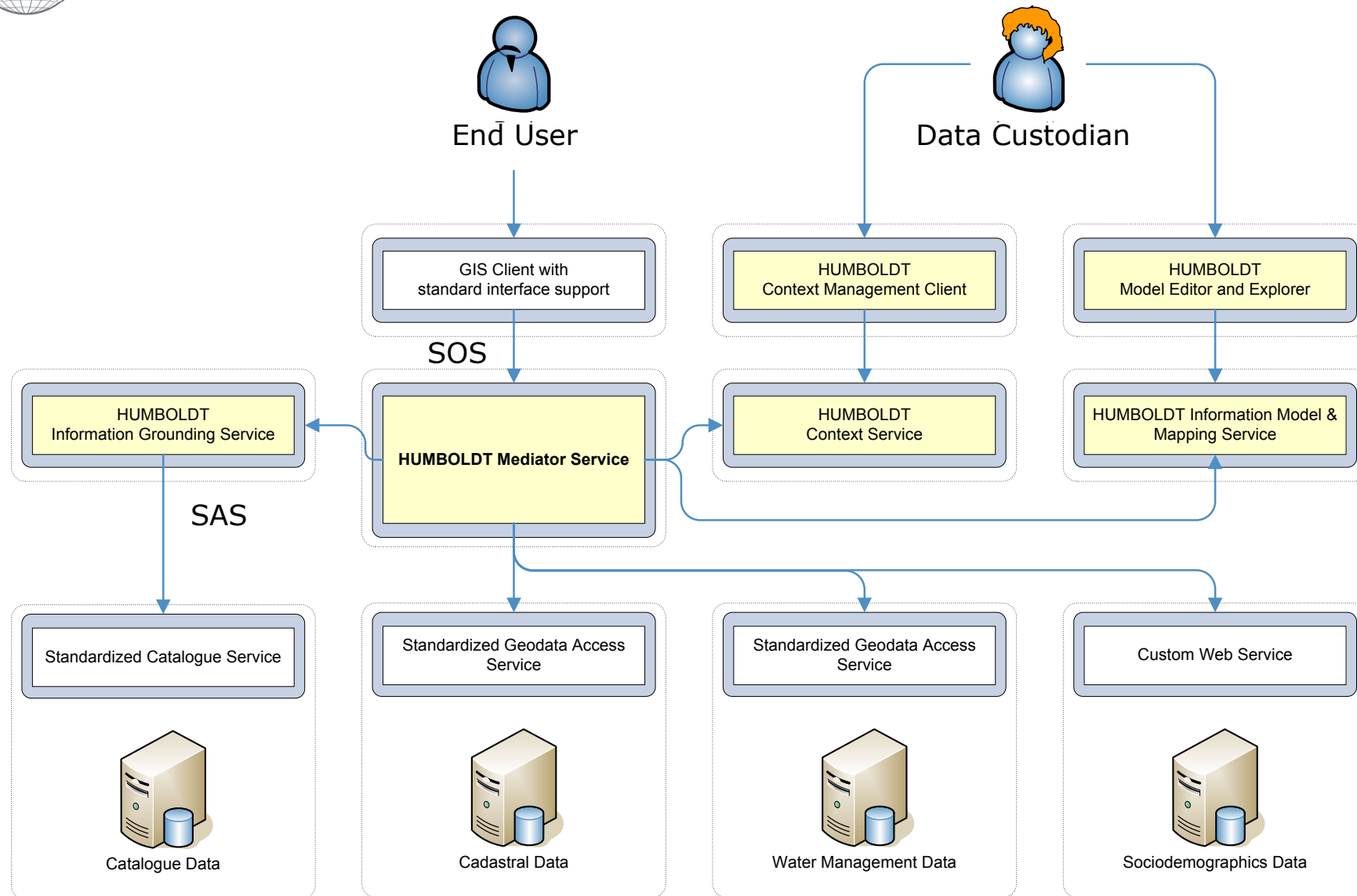
### “supporting the target definition” in the scenarios

- Data modeling tools
- Data mapping tools
- Schema catalogue tools



## HUMBOLDT Framework - Integration





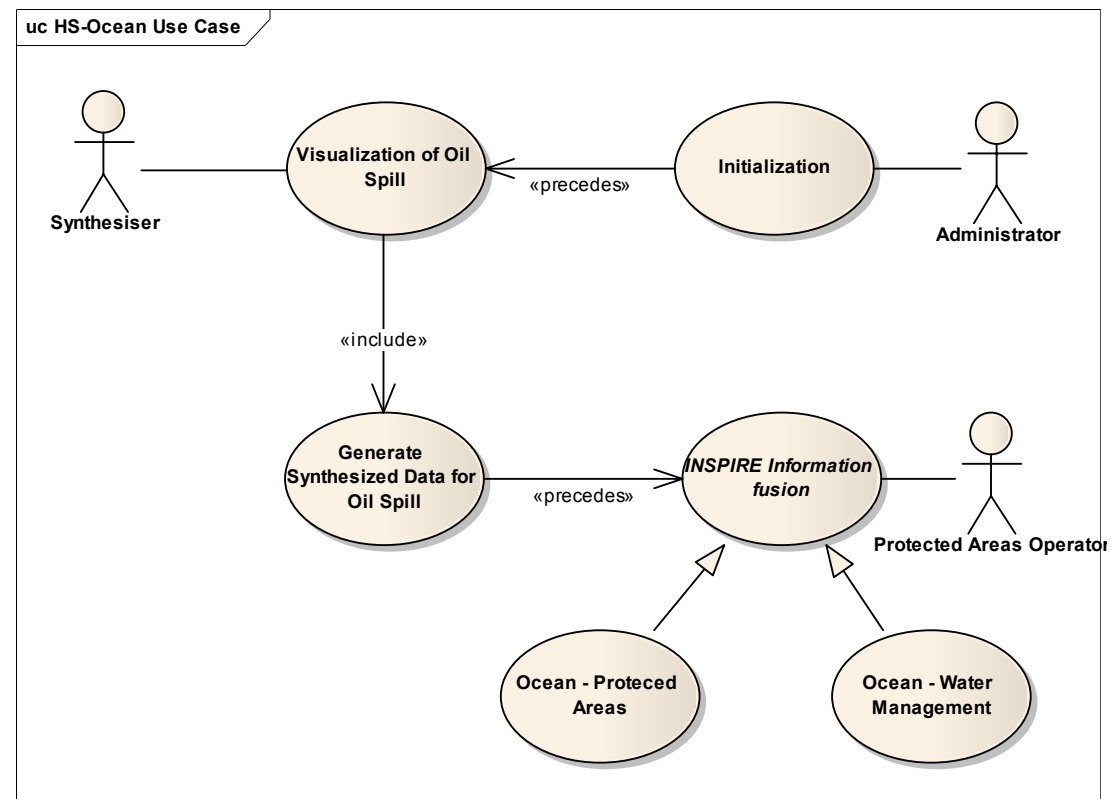


# Sensor Integration in the HUMBOLDT scenarios

## Ocean Scenario Use Cases

One of 4 sub-scenarios: Oil spill incident in the Southern Bight region of the North Sea.

Area is controlled under the Bonn agreement by three countries: France, Belgium and the United Kingdom



## Ocean Scenario Dynamic Data

### Meteorological data

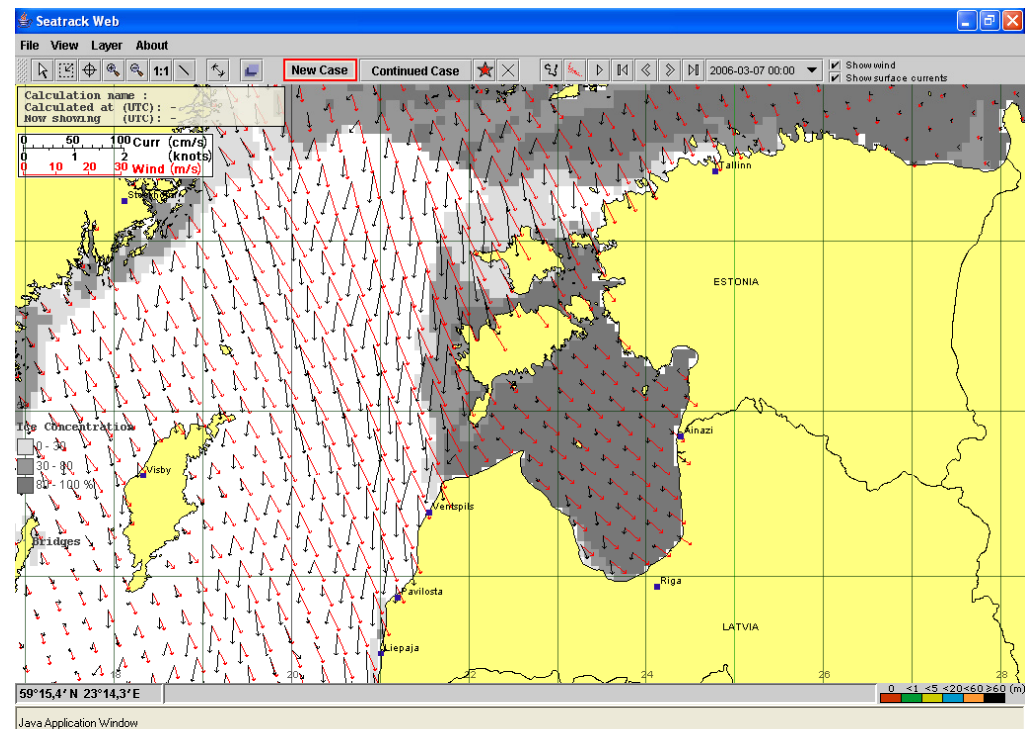
- Air Temperature, Wind...

### Oceanographic data

- Wave height, currents

### Oil spill drift model

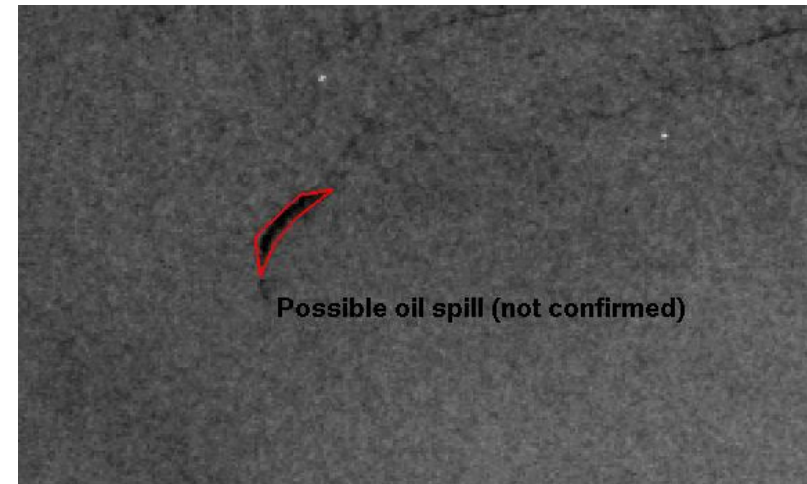
### Oil weathering model



## Ocean Scenario Aerial & Earth Observation Data

### SAR:

- Used for detection of oil spills
- Also, ship-based radars are sometimes available



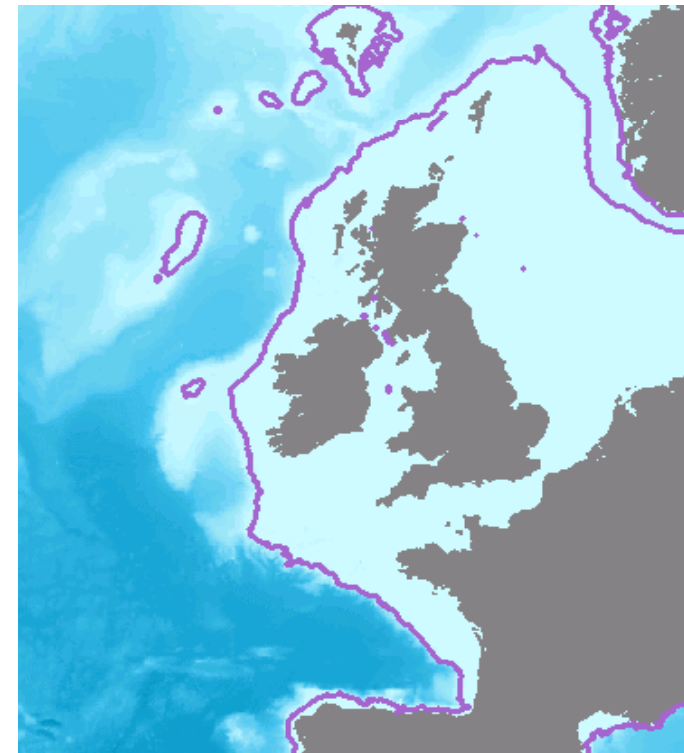
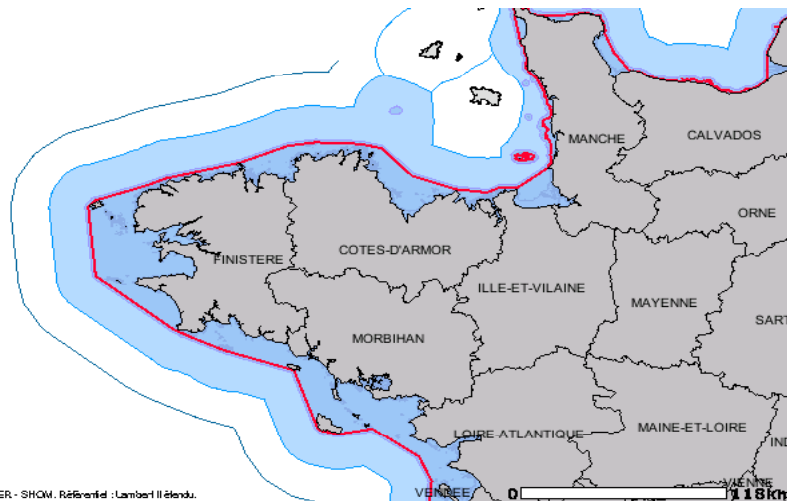
### Aerial Photography

- Used for getting more detailed information on the type of pollutant, behaviour and size



## Ocean Scenario Static Data

- Bathymetry
- Sensitive Areas maps
- Road networks
- Coastal installations (Harbours...)



## Ocean Scenario Sensors

### Tracking floats:

- Oil spills are marked by tracked floats, using active satellite positioning
- Used after identification of an oil spill for precise position tracking

### Coastal Observation Systems:

- Stationary systems on the coast with multiple sensors
- provides tide gauges, telemetry data, data collected by ferries

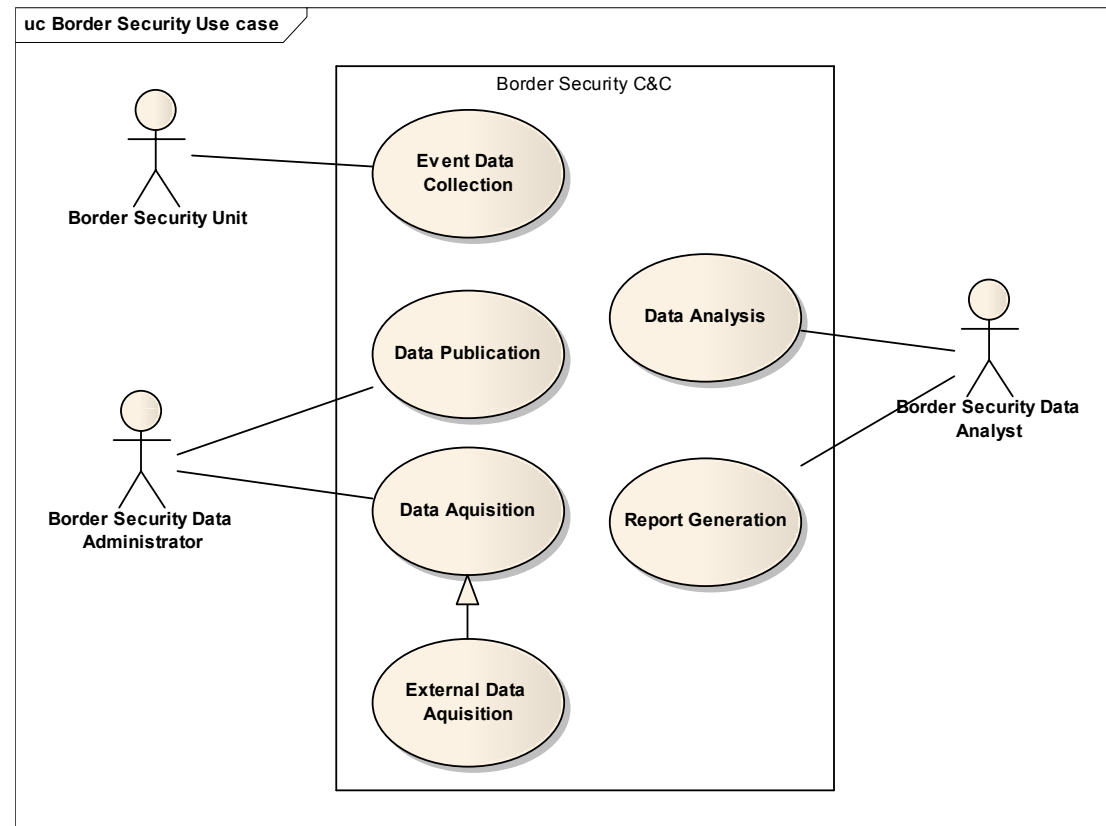
### Smart Buoys:

- Multiple-sensor systems providing continuous and interval measurements
- Wave height, meteorological data (temperature, wind direction & speed...)

## Border Security Scenario

▣ Security of the EU Outer Border/Schengen area (Hungary)

- ▣ Scenario focuses mainly on Security analysis and planning
- ▣ Also has a use case on intrusion which uses in-situ sensors



## Border Security Sensors and other data

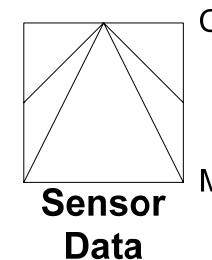
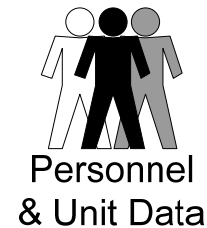
### Dynamic data (Sensors)

- Motion detection
  - Cameras
  - IR sensors
- Position of security staff
- Meteorological information

### Static data

- Orthophotos and satellite imagery
- Digital Terrain Model
- Land cover
- Transport networks
- buildings

Mapping Data



## Common Scenario Sensor Integration Issues

### ▣ Sensors don't necessarily have spatial location

- Data sets consist just of the (continuous) measurements and some human-readable metadata
- Storing data behind a “normal” WFS/WMS requires additional information and preprocessing

### ▣ Location can change over time (floats)

### ▣ Sensor input needs to be interpolated for output as a 2D/3D/3D+time visualisation

- Sensor input is routed through simulation software

## Summary

- ▣ Sensors are part of many of our application scenarios (HS-Ocean, HS-BorderSecurity, HS-Galileo, HS-ERiskA)
  
- ▣ A Data harmonisation framework needs to be able to handle/integrate sensor conceptual and logical schemata
  
- ▣ Our Approach leverages OGC SWE specification to be able to do so as well as domain-specific standards, such as SeaDataNet products.
  
- ▣ Specific issues still to handle:
  - There is – especially for databases with existing/old sensor data – lots of information missing for integration (such as location!)

 Thank you for your attention!



**Fraunhofer** Institut  
Graphische  
Datenverarbeitung

Thorsten Reitz  
M.Sc.

Department Geographic  
Information Systems

Fraunhoferstraße 5  
64283 Darmstadt  
Telefon +49 (0) 6151/155-416  
Fax +49 (0) 6151/155-444  
thorsten.reitz@igd.fraunhofer.de  
www.igd.fraunhofer.de/igd-a5