



## **Infrastructure for Spatial Information in Europe**

# **INSPIRE data specification**

**On the road to a European Elevation Data Standard  
AHN Gebruikersdag, 3 oktober 2007, Driebergen**

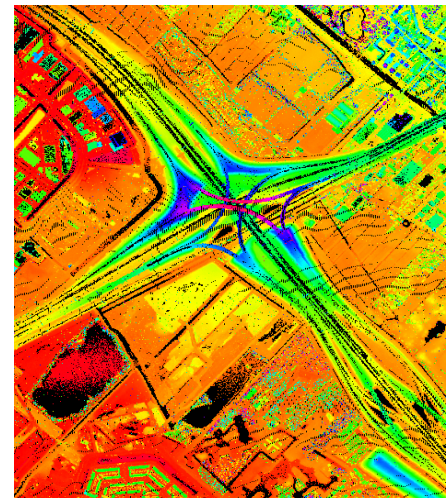
Peter van Oosterom

(partially based on sheets of  
Paul Smits and Marcel Reuvers)



# Outline

- Introduction
- Implementing Rules (IR) process
- Relevant INSPIRE themes
- Outlook and Conclusions





# Harmonizing geo-information in Europe

- Concerns about 34 different types of data sets
- 27 different countries with 22 languages (and more influence; e.g. Iceland is also affected)
- Agreement on content during **exchange**, considering consistency (within, but also) between:
  - Themes
  - Scales (levels of detail)
  - Borders



# Themes (annex I and II)

## Annex I:

- Coordinate reference systems
- Geographical grid systems
- Geographical names
- Administrative units
- Addresses
- Cadastral parcels
- Transport networks (*water,...*)
- Hydrography
- Protected sites

## Annex II:

- Elevation
- Land cover
- Orthoimagery
- Geology (*aquifers,..*)



## Themes (annex III)

- Statistical units
- Buildings
- Soil
- Land use
- Human health and safety
- Utility and Government services (*water supply, sewage,..*)
- Environmental monitoring facilities
- Production and industrial facilities (*water abstraction,..*)
- Agricultural and aquaculture facilities
- Population distribution – demography
- Area management/restriction/regulation zones & reporting units (*areas around drinking water,..*)
- Natural risk zones
- Atmospheric conditions
- Meteorological geographical features
- Oceanographic geographical features
- Sea regions
- Bio-geographical regions
- Habitats and biotopes
- Species distribution
- Energy resources
- Mineral resources



# Overall context

- Increasing calls for more information to support environmental policies at European and MS level
- Difficulties to manage existing information flows and obtain timely, accurate and policy-relevant information
- Need to take into account differentiation across regions with respect to the state of the environment
- Revision of approach to reporting and monitoring, moving to concept of sharing of information
- Spatial information plays a special role: early action needed



# Proposal INSPIRE Framework Directive General Provisions

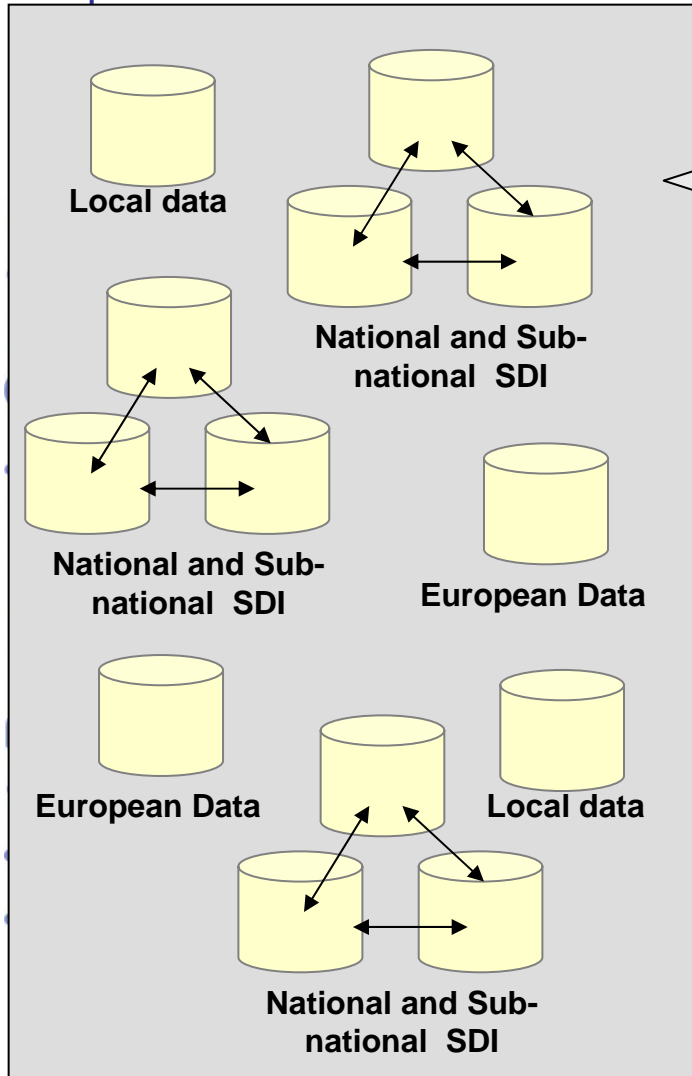
## Introduction

- INSPIRE lays down **general rules** for the establishment of an **infrastructure for spatial information in Europe** to support environmental policies and policies that affect the environment
  - This infrastructure shall be based on infrastructures for spatial information established and operated by the Member States.
- INSPIRE requires also specific **implementing rules** to be adopted through Comitology



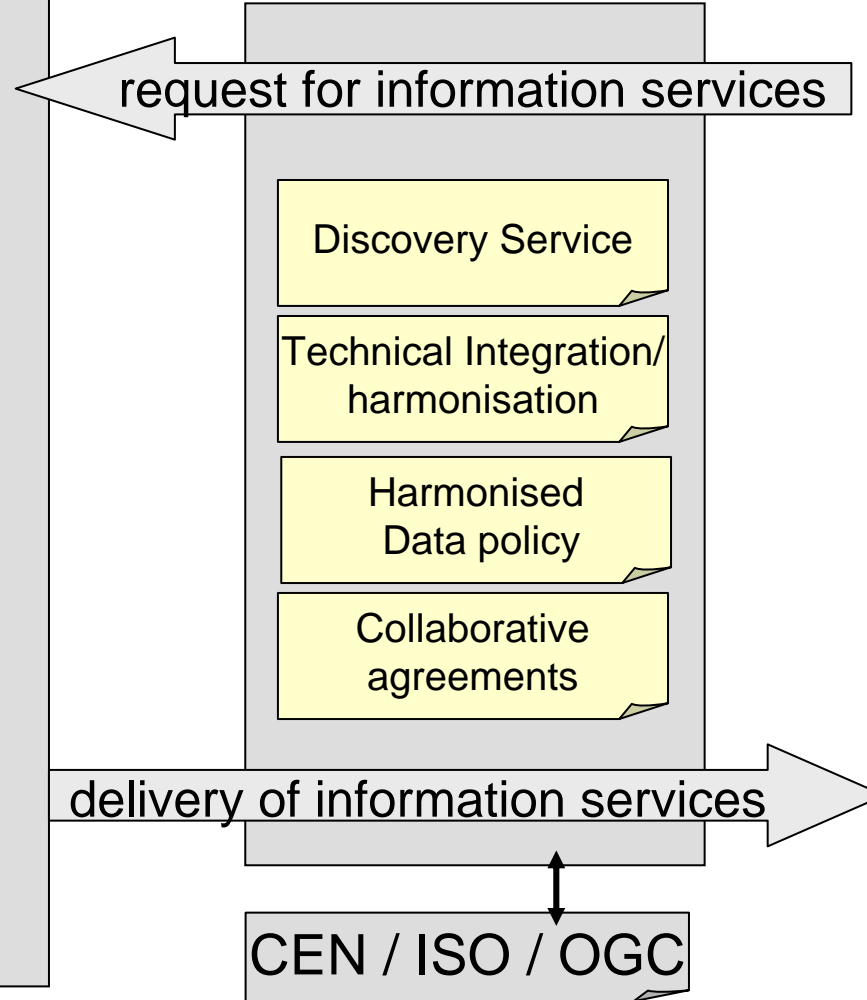
# INSPIRE Information Flow

## Data resources



SDI – Spatial Data Infrastructure

## INSPIRE specifications



## Users







# From proposal to directive

- 2.10.2002: Result of initial discussion documented in position papers on spatial data
- 23.7.2004: Proposal for a directive of the European parliament and of the Council: “establishing an infrastructure for spatial information in the Community (INSPIRE)”
- 21.11.2006: agreement by EU Parliament + Council
- 15.05.2007: INSPIRE Directive in force



# From Commission proposal to Community Directive implementation

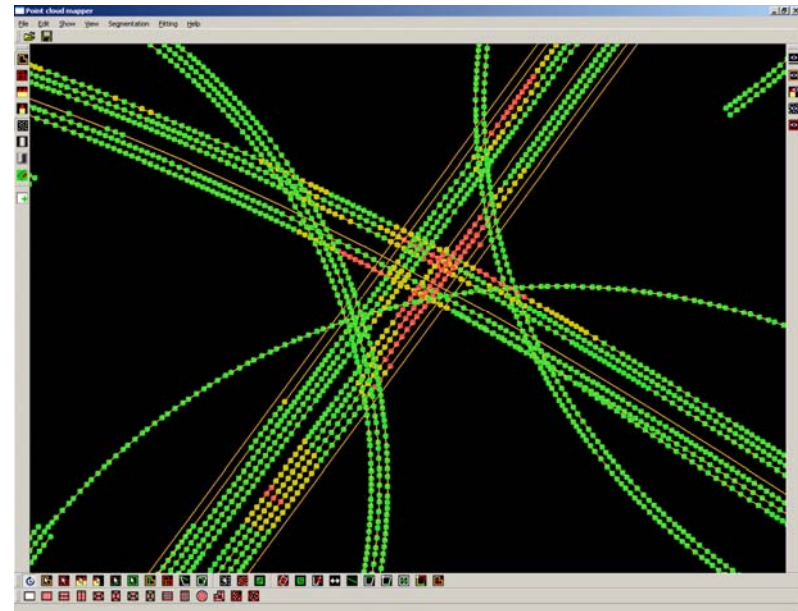
- Preparatory phase (2004-2006)
  - *Co-decision procedure*
  - Preparation of Implementing Rules
- Transposition phase (2007-2008)
  - Directive enters into force
  - Transposition into national legislation (NL VROM concept 'kaderwet INSPIRE' and revise other laws)
  - INSPIRE Committee starts its activities
  - Adoption of Implementation Rules by Committology
- Implementation phase (2009-2013)
  - implementation and monitoring of measures
  - Realization of EU (based on NL and ...) geo-portal





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# Overview of requirements/drafting teams (DT)

- metadata\*
- data specification\*
- network services\*
  - EU geo-portal
- access and rights of use for Community institutions and bodies\*\*
- monitoring and reporting mechanisms\*\*



\* technical: under JRC responsibility

\*\* legal/procedural: under Eurostat responsibility





## Time table (meta) data, in years after 15 may 2007

|           | Implementing rules (metadata) | Metadata (+after rules) | Implementing rules (data) | New data (+after rules) | Existing data (+after rules) |
|-----------|-------------------------------|-------------------------|---------------------------|-------------------------|------------------------------|
| Annex I   | 1<br>2008                     | (+2 =) 3<br>2010        | 2<br>2009                 | (+2 =) 4<br>2011        | (+7 =) 9<br>2016             |
| Annex II  | 1<br>2008                     | (+2 =) 3<br>2010        | 5<br>2012                 | (+2 =) 7<br>2014        | (+7 =) 12<br>2019            |
| Annex III | 1<br>2008                     | (+5 =) 6<br>2013        | 5<br>2012                 | (+2 =) 7<br>2014        | (+7 =) 12<br>2019            |



# DT Data specifications results until today

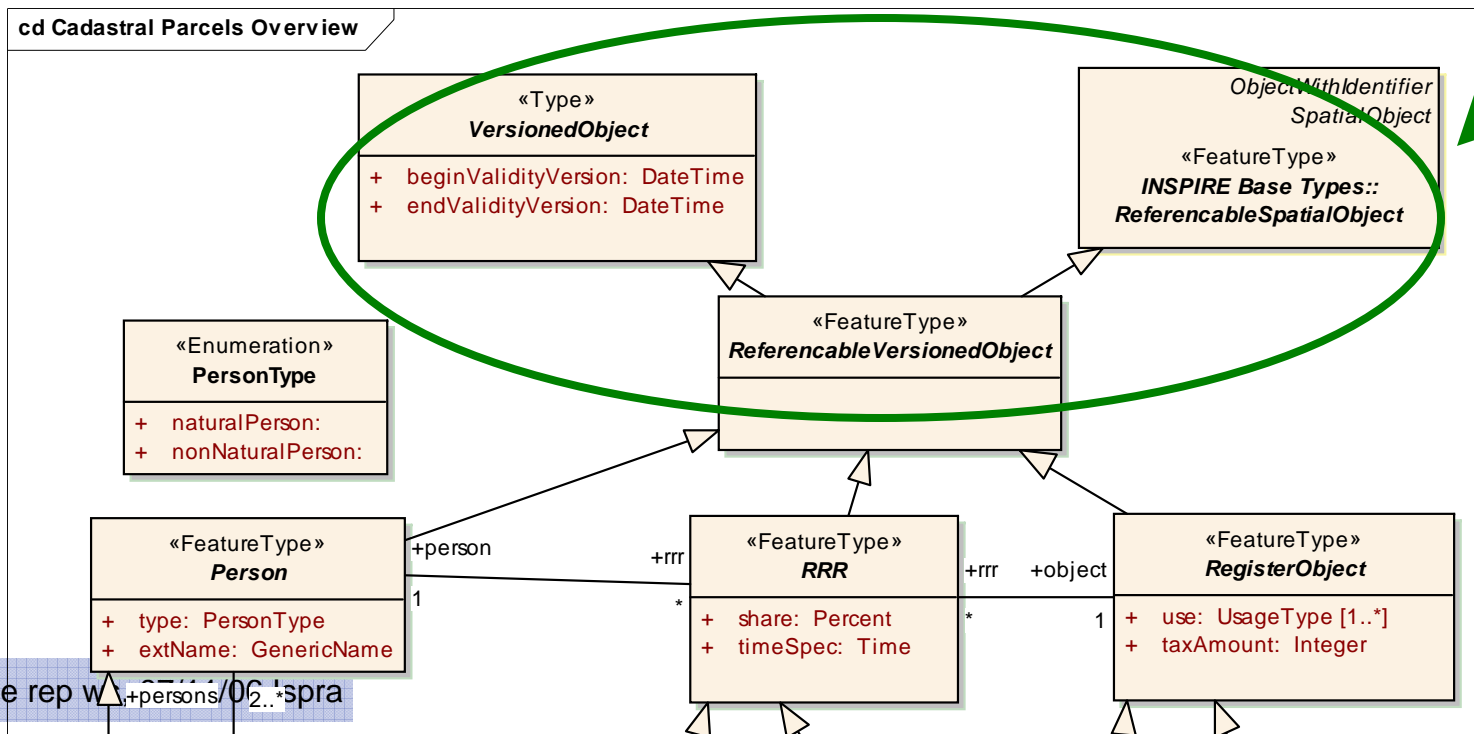
| Deliverable  | Status              |
|--|---------------------|
| D 2.3: Scope and Definition of Annex I/II/III Themes                 | Comments in         |
| D 2.5: Generic Conceptual Model (first draft)                        | Comments in         |
| D 2.6: Methodologies for data specifications (first draft)           | Open for comments   |
| D 2.7: Implementing rules for exchange of spatial data (first draft) | Not yet distributed |

Note not yet any theme specific data specification produced

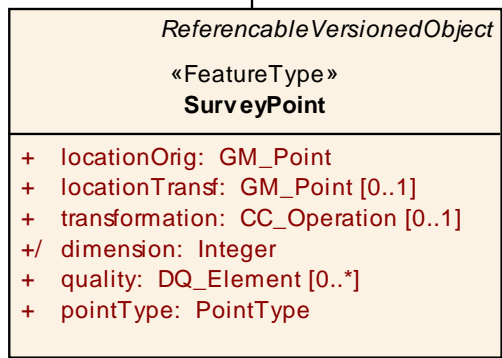
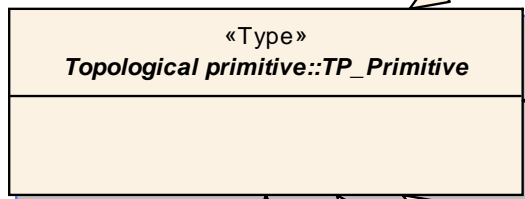
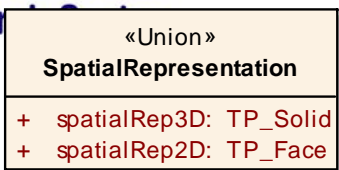


# Generic Conceptual Model (D2.5) as foundation for theme data specifications

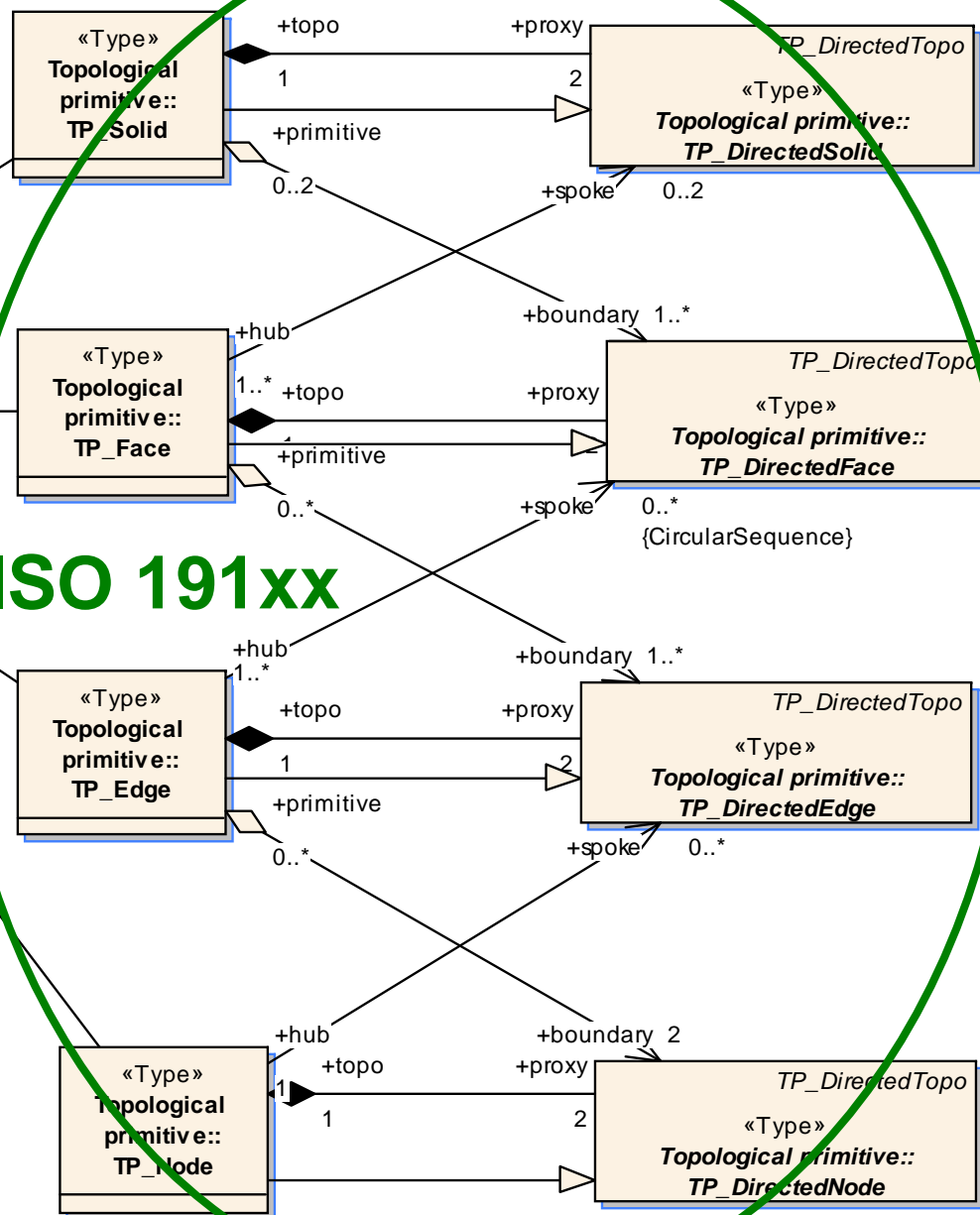
- Contains shared elements: id's, references
- Based on ISO 191xx standard series
- **Example** for cadastral parcels (method D2.6)







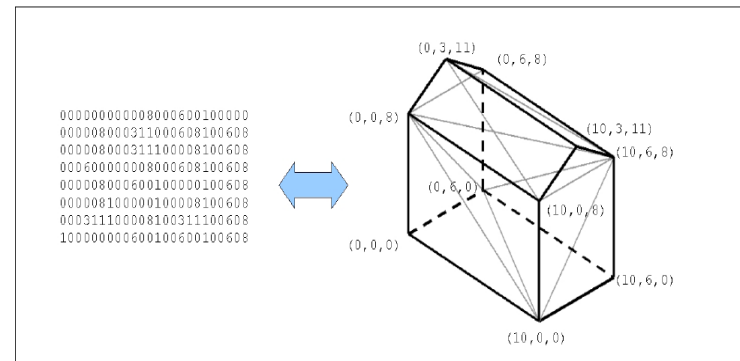
ISO 191xx





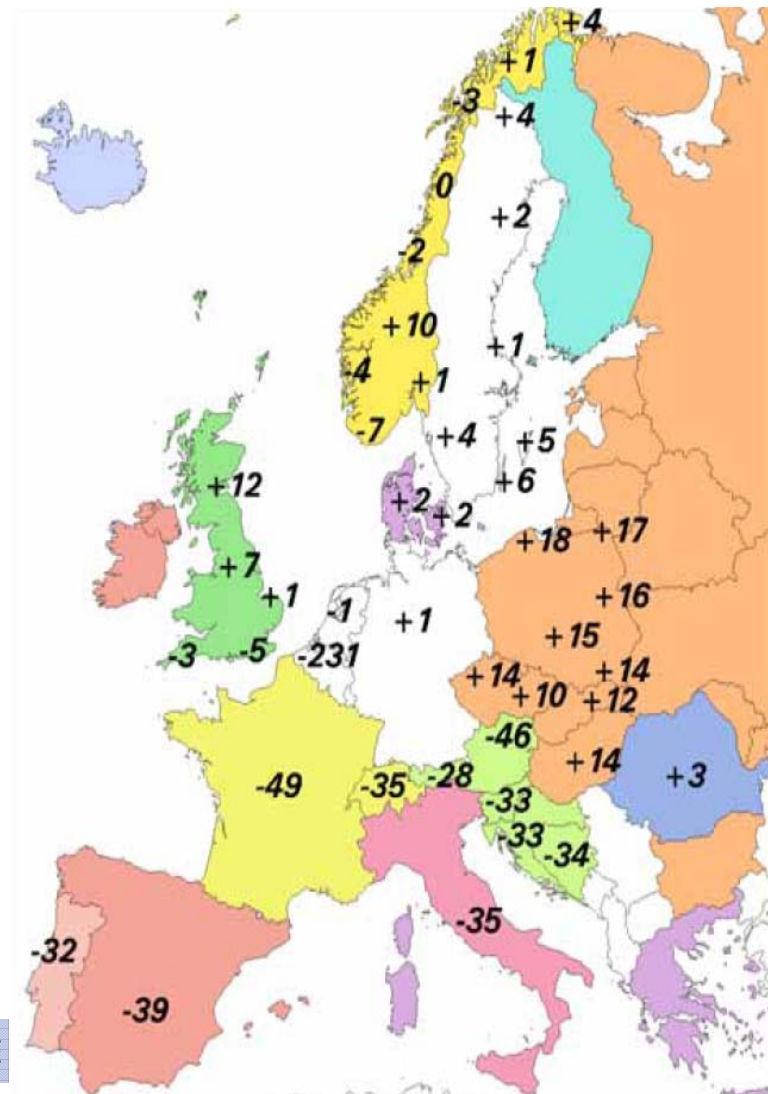
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# Differences in sea-level (in cm, source BKG)



14 jan'04



Bridge near Laufenburg collapsed due to altitude measurement difference of 0.54 m between Swiss and German side

Source [www.laufenburg.ch](http://www.laufenburg.ch)



## Relevant INSPIRE 'themes' (from directive)

- **Coordinate reference systems** (annex I): Systems for uniquely referencing spatial information in space as a set of coordinates (x,y,z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.
- **Geographical grid systems** (annex I): Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells.
- **Elevation** (annex II): Digital elevation models for land, ice and ocean surfaces. Includes terrestrial elevation, bathymetry and shoreline.



## More on elevation (from D2.3, sec 6.1)

- The theme includes:
  - terrestrial elevation, e.g.
    - Digital elevation information and digital elevation models for land surface and surface of inland waters.
    - Simplified or pre-processed data as contours. Spot Heights.
  - Bathymetry, e.g. a gridded bottom model
- The requirements on vertical and horizontal accuracy of data should be investigated. The large scale dataset might have different accuracy in flat areas and areas with steeper slopes. The slope % and frequency parameters that define which areas have the different quality requirements should be defined.





## Scope, use examples (D2.3, sec 6.1)

- Modelling of land slides and avalanches, flooding vulnerability, risk to erosion, flow of water and pollutants, spread of air pollution, fires, noise, and biodiversity.
- Environmental applications
- Water supply, understanding of flow pattern and chemical composition in water
- Energy sector
- Agricultural and forestry
- Safety at sea, Assessment of location of pipelines
- Location valuable biodiversity sites/shallow waters,
- Location sea resources and valuable sites



## Important feature types and attributes (D2.3, sec 6.1)

Vector data:

- Contour line and depth contour: altitude
- Breakline: category (crest, thalweg, other)
- Spot height: altitude, category (summit, mountain pass, ...), name (?)
- Sounding: altitude
- High and low water line

Coverage data:

- DEM as regular grid, in different resolutions, for land and sea bottom.

→ What about irregular point clouds?





# Theme Links and reference material

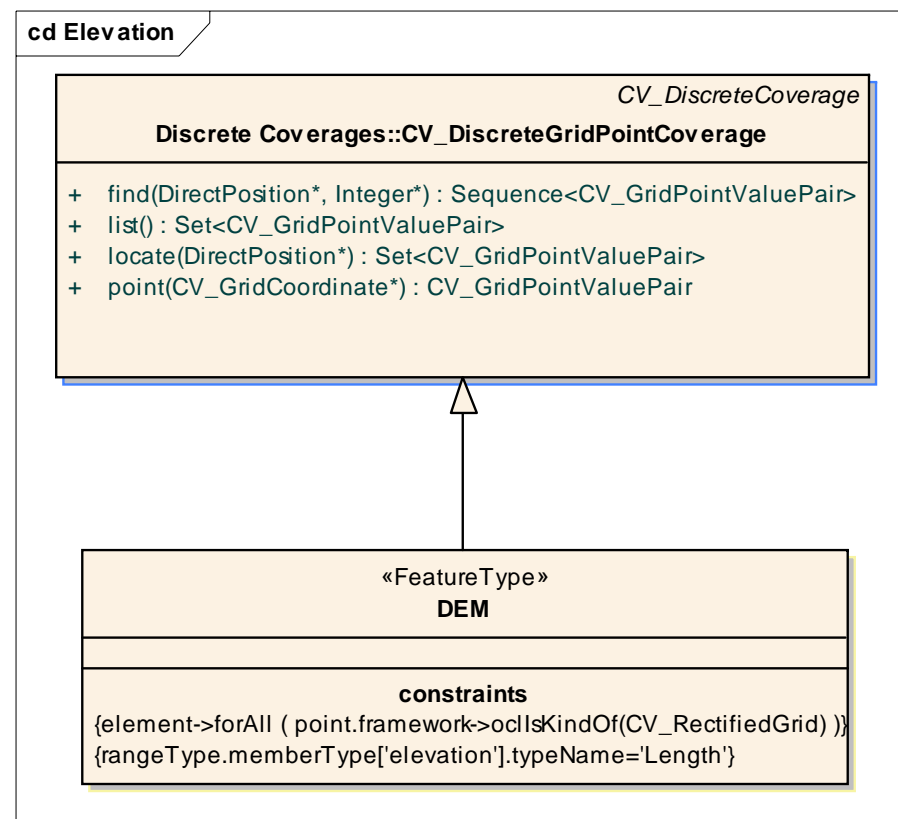
- Administrative boundaries, Geographical Names, Hydrography, Orthoimagery, Buildings, ...
- LMO/SDIC's provided:
  - Institut Géographique National (France): BD Alti Descriptif technique
  - Submitted by INTESA GIS (Italy): Technical Specifications for the Elaboration of Digital Elevation Models

(available from <http://www.ec-gis.org/inspire>)



## Example harmonized data specification of theme 'Elevation' (from D2.6, annex C.2)

- Informal description:  
The Elevation data is provided in coverage structure by DEM. The harmonisation process includes resampling of input data to a uniform pan-European grid. Measurement unit of elevation data is meter.





## From the **example** elevation spec's (D2.6)

- DEM: regular Grid with a spacing of 50 meters in conformance with **recommendation 18** of the Generic Conceptual Model (GCM, D2.5)
- The horizontal coordinate reference system is a projected CRS with datum ETRS89 in European Lambert Azimuthal Equal Area projection using a metric coordinate system; the projection is centred on N 52°, E 10° (**convert to from Dutch RD?**)
- The vertical coordinate reference system is EVRF2000, normal height of the UELN\_95/98 (**NAP?**)
- Portrayal: information to be added once template for View service from DT NS is available



## Recommendation 18 (from GCM, D2.6)

The following geographical grid system (based on the proposal in the document “European Reference Grids”, volume EUR 21494 EN, published by JRC, online available at <http://gi-gis.jrc.it/publist/annoni2005eurgrids.pdf>, see Clause 2) should be used whenever possible and appropriate for gridded spatial data:

- The coordinate reference system is a projected CRS with datum ETRS89 in European Lambert Azimuthal Equal Area projection using a metric coordinate system; the projection is centred on N 52°, E 10°.
- Grids are rectified grids of dimension 2.
- The first grid axis is in direction east (axis name: "E"), the second grid axis is direction north (axis name: "N").
- The cell size is any of the following: 1x1m, 2.5x2.5m, 5x5m, 10x10m, 25x25m, 50x50m, 100x100m, 250x250m, 500x500m, 1x1km, 2.5x2.5km, 5x5km, 10x10km, 25x25km, 50x50km, 100x100km, 250x250km, 500x500km, 1000x1000km (i.e. using a power of 10 with two quad tree subdivisions).
- The origin of a grid is at a direct position where each ordinate value divides evenly by the cell spacing. For example, the coordinates (578100,436200) may be used as the origin of grids with cell sizes 1x1m, 2.5x2.5m, 5x5m, 10x10m, 25x25m, 50x50m, and 100x100m, but none of the other grid cell sizes.

Such coverages shall be instances of the spatial object type CV\_DiscreteGridPointCoverage. The grid itself shall be a CV\_RectifiedGrid.



## Consistency between spatial data sets

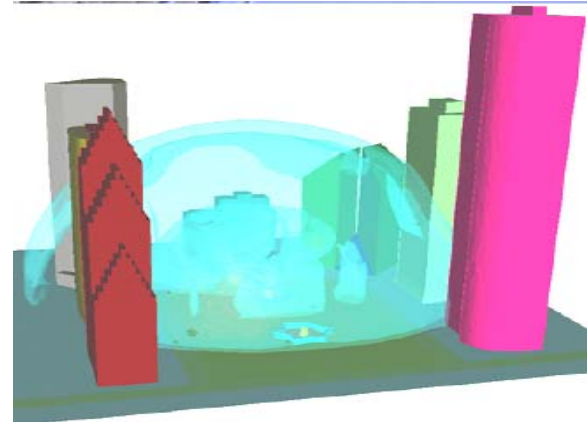
- The Digital Elevation Model (DEM) shall be hydrographically correct, i.e. water does not flow upwards or is captured in a lake which is an artefact of the DEM and not a real-world phenomena
- The constraint may be expressed in the hydrography data specification in OCL as:

```
context r : RiverWaterBody inv:  
Distance.allInstances->forall( d1, d2 |  
(d1<d2 and d1>=r->startParam() and d2<=r->endParam()) implies  
DEM.allInstances->forall( dem |  
dem->evaluate(param(d1),"elevation")->first()->locate("elevation") >=  
dem->evaluate(param(d2),"elevation")->first()->locate("elevation"))
```



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## Outlook

- IINSPIRE directive adopted 15 may 2007
- After adoption of INSPIRE Directive, SDIC/LMO review of selected draft Implementing Rules can start
- EU financial support for INSPIRE in 6<sup>th</sup> and 7<sup>th</sup> Framework Programmes (e.g. HUMBOLDT project: <http://www.esdi-humboldt.eu>)





# Conclusions

- INSPIRE is a framework Directive with implementing rules to be defined in the coming years
- Highest involvement of key stakeholders through the SDIC and LMO concepts
  - SDIC/LMO contribute to make the process to develop INSPIRE manageable and efficient
- Openness and transparency in drafting implementing measures will be followed
  - including formal public consultation



# Conclusion, data specs

- Thematic working groups (TWGs):
  1. Community has already agreed on spec
  2. Proposed contributions and raw material
  3. Insufficient material, to be developed
- Call for participating SDIC/LMOs and candidate specs (open for annex I themes until **3 oct'07** and April 2009 for Annex II and III)
- Annex I (and linked II and III) TWGs start working nov'07



## Conclusion, elevation data

- Most likely our Dutch specs will be higher than the INSPIRE data specs (only cover **exchange**)
- INSPIRE also includes metadata and network services (e.g. **XML** based transfer) and regulations
- Consider to bring in Dutch expertise in the process (at least before apr'09, but because of links with Annex I themes perhaps register AHN as SDIC today and provide input)
- Elevation data will become more and more key part of the spatial information infrastructure; integrated with topographic data; RGI-011 **project 3D topo**



# 3D Topography

[www.rgi-otb.nl/3dtopo](http://www.rgi-otb.nl/3dtopo)  
[www.3D-GeoInfo-07.nl](http://www.3D-GeoInfo-07.nl)

International workshop Delft 12-14 dec'07

**RGI-011: 3D Topography**

click here

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project home  
partners  
events  
publications  
intranet  
links

**NEWS -- 3D topography project initiates international workshop 3D GeoInfo 07**

**3Dgeoinfo07**

From 12-14 December 2007, TU Delft will host 3D GeoInfo 07, the 2nd International Workshop on 3D Geo-Information: Requirements, Acquisition, Modelling, Analysis, Visualisation. The Workshop aims at bringing together international state-of-the-art research in the field of 3D geo-information. It offers an interdisciplinary forum to researchers in the closely related fields of:

- Data collection and modelling: advanced approaches for 3D data collection, reconstruction and methods for representation.
- Data management: topological, geometrical and network models for maintenance of 3D geo-information.
- Data analysis and visualisation: frameworks for representing 3D spatial relationships, 3D spatial analysis and algorithms for navigation, interpolation, etc. Advanced Virtual Reality and Augmented Reality visualisation.

The Workshop is intended as an interactive platform for both presentations on state-of-the-art research and discussions on open problems. The workshop will consist of a mixture of single-track presentations and discussion (PD) sessions and parallel working group (WG) sessions on specific themes (Requirements, Acquisition, Modelling, Analysis, Visualisation), according to the following format: current problems to be solved, potential solutions, and recommendations by WG (discussion under coordination of a chair and final presentation of the results at the closing plenary session). The presentations will be selected based on their quality by the scientific program committee (peer review of full papers).

**Project home 3D topo**

Space for Geo-information, project RGI-011 '3D topography':

There is an increasing need for real 3D topography due to a broad range of applications. Four prototypical applications are analysed with regard to the user wishes and the resulting 3D model requirements. On this basis, a new 3D topographical product model is further developed together with new methods and techniques and for data collection, storage and analysis. The project is spread over the period 2005-2006 and consists of the following sub-projects:

SUB1 Research on accessibility and user requirements of 3D topographic data and systems.

**3Dgeoinfo07**

Home // Background // Organisation // Workshop topics // Call for papers // Paper submission // Registration // Program // Venue // Contact

**3Dgeoinfo07**

**NEW:** the preliminary program can be found at [Program](#)

**2nd International Workshop on 3D Geo-Information: Requirements, Acquisition, Modelling, Analysis, Visualisation**

12-14 December 2007, Delft, the Netherlands

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home