

# Interoperability of (open) geospatial data – INSPIRE and beyond

**Michael Lutz**, Andrea Perego, Massimo Craglia

Open Data on the Web, 23-24 April 2013, London

**@michellutz**

**{first.last}@jrc.ec.europa.eu**  
**www.jrc.ec.europa.eu**

*Serving society*  
*Stimulating innovation*  
*Supporting legislation*



# INSPIRE in a nutshell

- Legal framework for establishing an infrastructure for spatial information in Europe
  - data inventory
  - data sharing principles
  - discovery services & metadata
  - view, download & transformation services
  - common cross-domain data models and vocabularies
- 34 spatial data themes
- Development process involving experts & stakeholders from all EU Member states
- Implementation 2009-2020
- Growing interest in creating innovative products and services based on INSPIRE and other data (public, private, citizens)





## INSPIRE in a nutshell

- Legal framework for establishing an infrastructure for spatial information in Europe
  - data **inventory**
  - data sharing principles
  - **discovery** services & **metadata**
  - view, **download** & **transformation services**
  - common **cross-domain data models** and vocabularies

discoverability

transformation  
(to other  
formats)

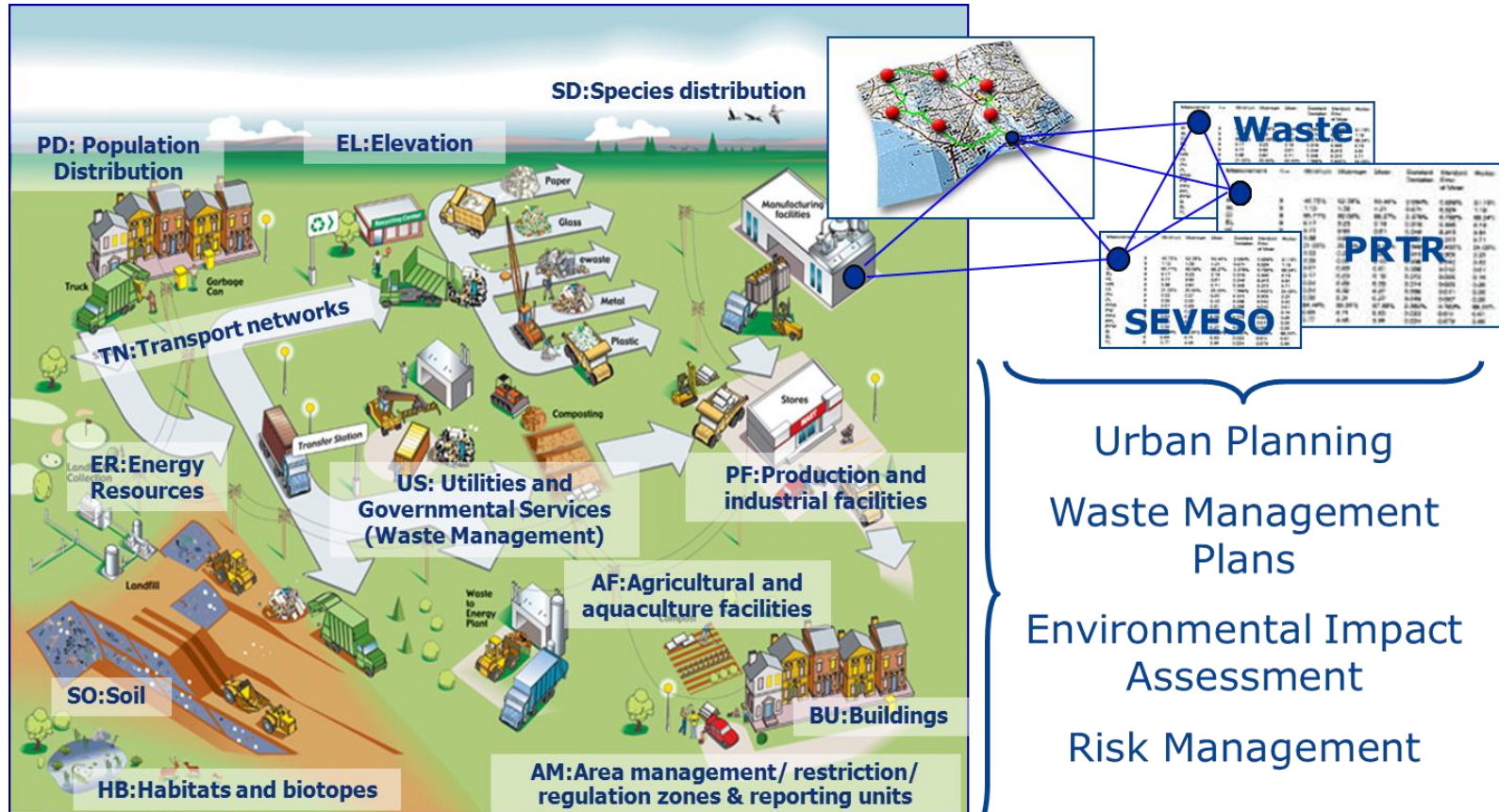
- 34 spatial data themes
- Development process involving experts & stakeholders from all EU Member states
- Implementation 2009-2020
- Growing interest in **creating innovative products and services** based on INSPIRE and other data (public, private, citizens)

combinations  
of data from  
different models

extracting human-  
readable "stories"  
from data

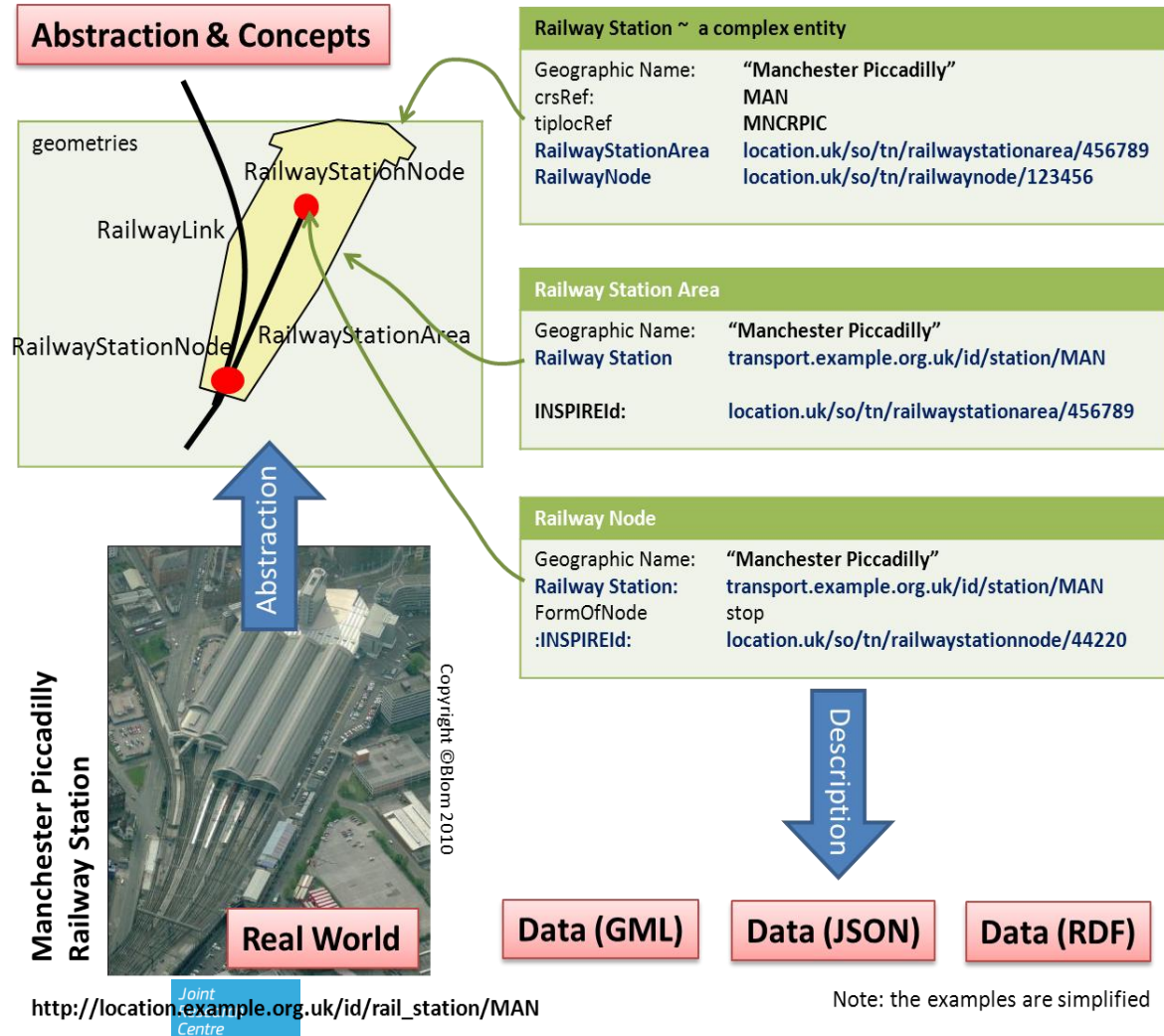
# Beyond INSPIRE – Key issues

- Enriching INSPIRE data models with application-specific “business” data



# Beyond INSPIRE – Key issues

- Cross-sector interoperability
  - INSPIRE & RDF
  - Creating and managing persistent identifiers
  - Creating and managing mappings from local to common data models and vocabularies



# Beyond INSPIRE – Key issues

- Implications of “opening up” data for the organisations
  - governance
  - long-term commitments
  - costs and benefits



# Addressing the key issues

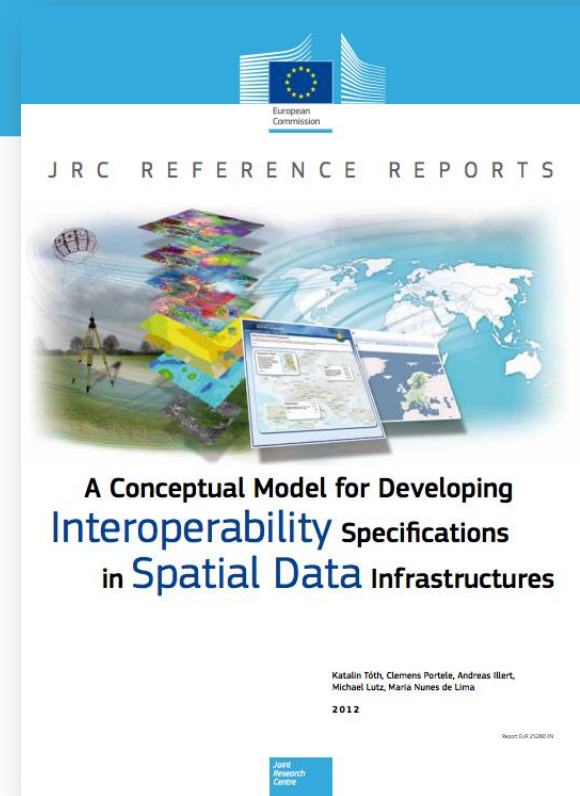
- INSPIRE maintenance and implementation
- 
  - Re-usable INSPIRE reference platform **ARe<sup>3</sup>NA**
    - Identify gaps and help sharing cross-sector re-usable components, e.g. INSPIRE registry
  - EU Location Framework **EULF**
    - Enable cross-sector interoperability of location information in Europe, based on INSPIRE (through standards, case studies , guidelines, ...)
- INSPIRE experience → global & mainstream ICT standardisation, e.g.
  - W3C LOCADD Community Group
  - Research Data Alliance (RDA)

# Thank you ... Questions?

- INSPIRE
  - web: <http://inspire.jrc.ec.europa.eu/>
  - twitter: @INSPIRE\_EU
- ISA programme
  - web: <http://ec.europa.eu/isa/>

**Join us at the INSPIRE Conference in  
Florence 23-27 June 2013**

[http://inspire.jrc.ec.europa.eu/events/conferences/inspire\\_2013/](http://inspire.jrc.ec.europa.eu/events/conferences/inspire_2013/)



# Interoperability of (open) geospatial data – INSPIRE and beyond

Michael Lutz, Andrea Perego, Massimo Craglia  
**Additional slides**



**{first.last}@jrc.ec.europa.eu**  
**www.jrc.ec.europa.eu**

*Serving society*  
*Stimulating innovation*  
*Supporting legislation*

## Abstraction & Concepts

### EnvironmentalMonitoringFacility

geometry  54.34°N, 7.24°E

mobile false

name A-130

inspireId [http://location.example.de/so/ef/abc\\_aq/c23456](http://location.example.de/so/ef/abc_aq/c23456)

purpose air monitoring

observed property CO, O3, NO2

...

Description

Abstraction

### Air Monitoring Station

#### Real World



[http://location.example.de/id/monitoring\\_station/A-130](http://location.example.de/id/monitoring_station/A-130)

```
<ef:EnvironmentalMonitoringFacility gml:id="c23456">
  <gml:identifier>
    http://location.example.de/so/ef/abc_aq/c23456
  </gml:identifier>
  <ef:mobile>>false</ef:mobile>
  <ef:purpose xlink:title="air monitoring"
    xlink:href="http://inspire.ec.europa.eu/codelist/purposeofcollection/air" />
  <ef:geometry>
    <gml:Point srsName="http://www.opengis.net/def/crs/EPSSG/0/4258">
      <gml:pos>54.34 7.24</gml:pos>
    </gml:Point>
  </ef:geometry>
  ...
</ef:EnvironmentalMonitoringFacility>
```

Data (GML)

<http://abc.de/doc/aq?...GetFeatureById&ID=c23456>

```
{ "entityType": "EnvironmentalMonitoringFacility",
  "geometry": { "x": 7.24, "y": 54.34, "spatialReference": { "wkid": 4258 } },
  "attributes": {
    "id": "http://location.example.de/so/ef/abc_aq/c23456",
    "mobile": false,
    "purpose": "air monitoring",
    ...
  }
}
```

Data (JSON)

<http://abc.de/doc/aq?...GetFeatureById&ID=c23456&outputFormat=application/json>

Note: the example is simplified

# Abstraction & Concepts

## CadastralParcel

geometry



cadastral ref. 07012302802550001

inspire id <http://location.example.de/so/cp/DEAAA/DERPAL00ah5ztj3js2>

area value 673.5 m<sup>2</sup>

Description

Abstraction

## Cadastral Parcel



Real World

<http://location.example.de/id/parcel/07/123/28/255-1>

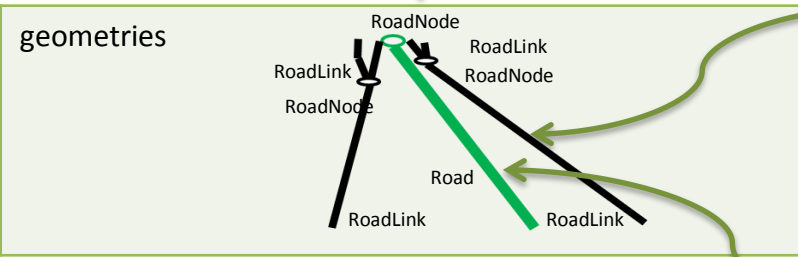
```
<cp:CadastralParcel gml:id="DERPAL00ah5ztj3js2">
  <gml:identifier>
    http://location.example.de/so/cp/DEAAA/DERPAL00ah5ztj3js2
  </gml:identifier>
  <cp:areaValue uom="m2">673.5</cp:areaValue>
  <cp:label>255/1</cp:label>
  <cp:nationalCadastralReference>
    07012302802550001
  </cp:nationalCadastralReference>
  <cp:geometry>
    <gml:Polygon>... </gml:Polygon>
  </cp:geometry>
  ...
</cp:CadastralParcel>
```

Data (GML)

<http://xyz.de/doc/parcels?...&ID=DERPAL00ah5ztj3js2>

Note: the example is simplified

# Abstraction & Concepts



### Road Node

Geographic Name: **"Langstone Interchange"**  
**Interchange{RoadNode}:** [transport.example.org.uk/id/interchange/LANG](http://transport.example.org.uk/id/interchange/LANG)  
 nationalRoadCode: **A27**  
 INSPIREid: [location.example.org/so/tn/roadnode/ha/44220](http://location.example.org/so/tn/roadnode/ha/44220)

### Road Links

Geographic Name: **"Havant Bypass"**  
**Road Link:** [transport.example.org.uk/id/road/A27](http://transport.example.org.uk/id/road/A27)  
 nationalRoadCode: **A27**  
 INSPIREid: [location.example.org.uk/so/tn/roadlink/osgb/67890](http://location.example.org.uk/so/tn/roadlink/osgb/67890)

### A Class National Road

Geographic Name: **"Havant Bypass"**  
 nationalRoadCode: **A27**  
 Road **INSPIREid** [transport.example.org.uk/id/road/A27](http://transport.example.org.uk/id/road/A27)  
[location.example.org.uk/so/tn/road/ha/86420](http://location.example.org.uk/so/tn/road/ha/86420)  
 Geometry (via a list of RoadLinks by ref.): [location.example.org.uk/so/tn/roadlink/osgb/67890](http://location.example.org.uk/so/tn/roadlink/osgb/67890)  
 .....

Abstraction

Description

Data



A27 – Havant Bypass & Langstone Interchange

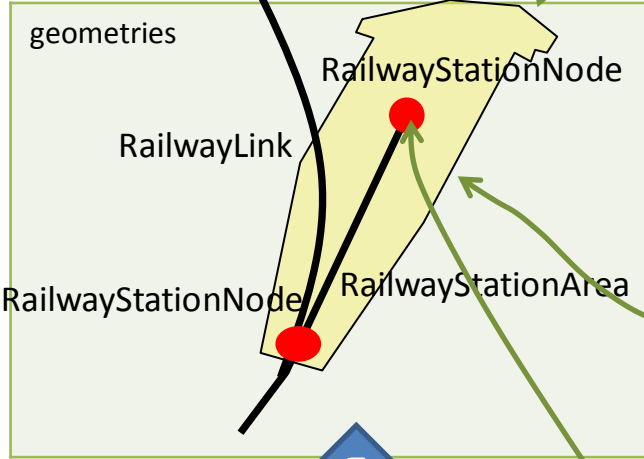
Real World

<http://location.example.org.uk/id/interchange/LANG>

As web documents/Information resources eg: GML/RDF/JSON as [.../doc/..](#)

Note: the examples are simplified

# Abstraction & Concepts



## Railway Station ~ a complex entity

Geographic Name: "Manchester Piccadilly"  
crsRef: MAN  
tiplocRef: MNCRPIC  
RailwayStationArea: location.uk/so/tn/railwaystationarea/456789  
RailwayNode: location.uk/so/tn/railwaynode/123456

## Railway Station Area

Geographic Name: "Manchester Piccadilly"  
Railway Station: transport.example.org.uk/id/station/MAN  
INSPIREId: location.uk/so/tn/railwaystationarea/456789

## Railway Node

Geographic Name: "Manchester Piccadilly"  
Railway Station: transport.example.org.uk/id/station/MAN  
FormOfNode: stop  
INSPIREId: location.uk/so/tn/railwaystationnode/44220

Abstraction

Description

Manchester Piccadilly  
Railway Station



Copyright © Blom 2010

Real World

Data (GML)

Data (JSON)

Data (RDF)

[http://location.example.org.uk/id/rail\\_station/MAN](http://location.example.org.uk/id/rail_station/MAN)

Note: the examples are simplified

# INSPIRE thematic scope

## Annex I

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Addresses
6. Cadastral parcels
7. Transport networks
8. Hydrography
9. Protected sites

## Annex II

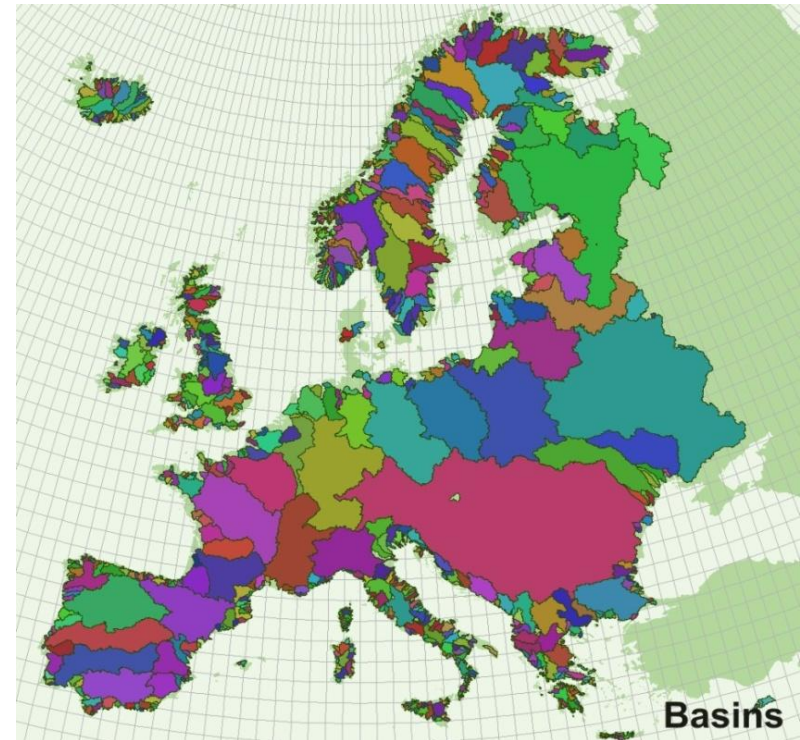
1. Elevation
2. Land cover
3. Ortho-imagery
4. Geology

## Annex III

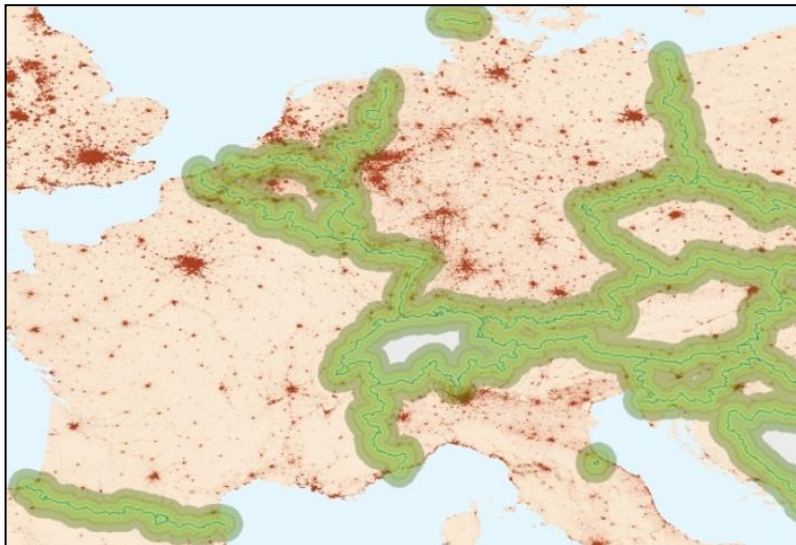
1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and governmental services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution – demography
11. Area management/ restriction/regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy Resources
21. Mineral resources

# Why Europe needs a spatial data infrastructure (SDI)?

- Natural Disasters and as well as other environmental phenomena do not stop at national borders!
- 20% of the EU citizens (115 million) live within 50 Km from a border

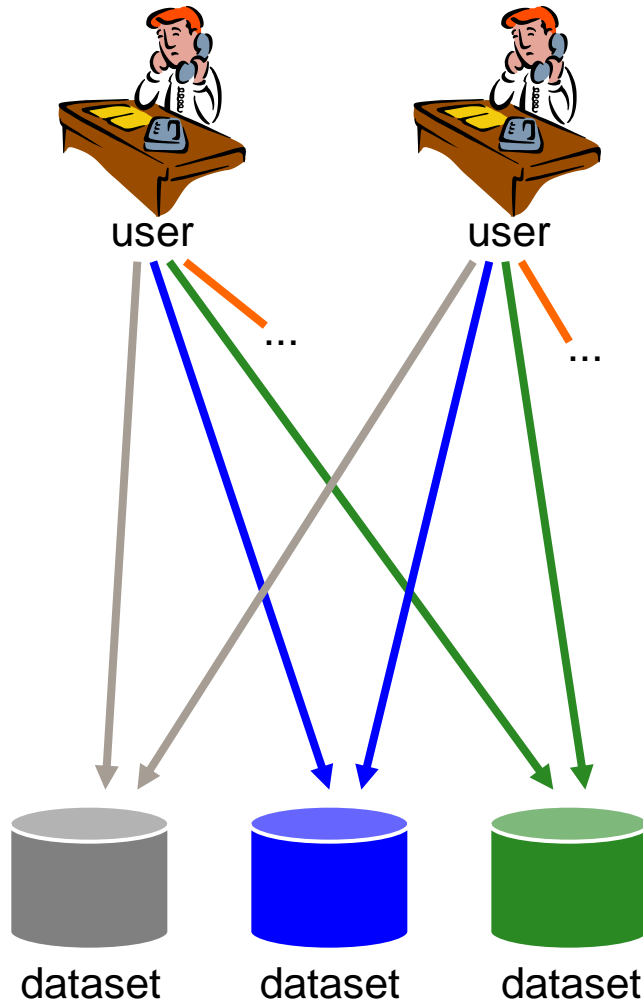


- 70% of all fresh water bodies in Europe are part of a trans-boundary river basin !!





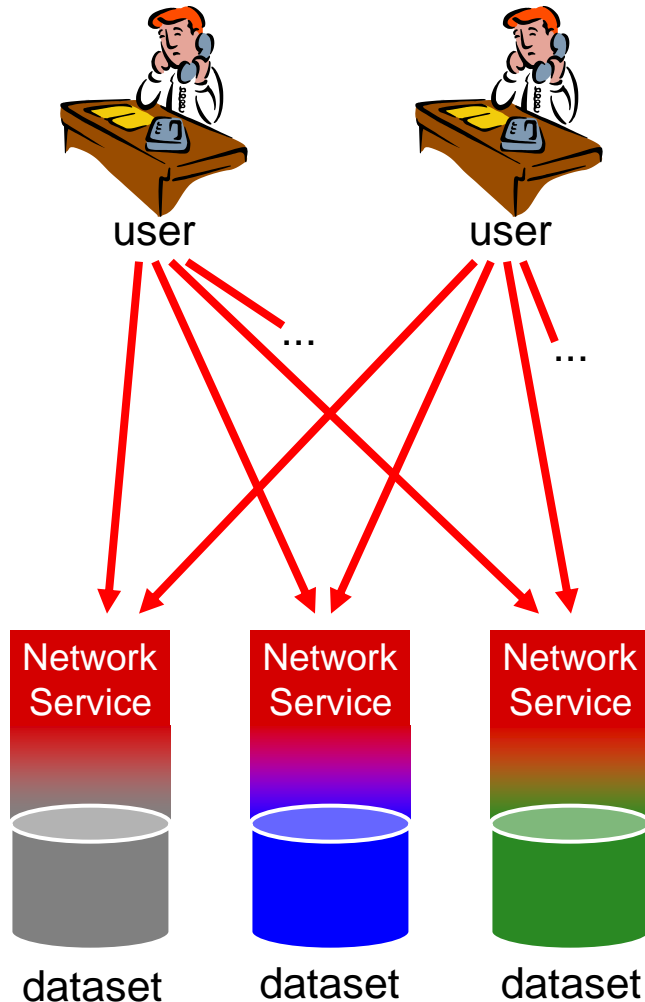
# Data interoperability



## The starting point ...

- Access to spatial data in various ways
- User has to deal with interpreting **heterogeneous data** in different formats, identify, extract and post-process the data he needs  
→ **lack of interoperability**

# Data interoperability



... and what INSPIRE is aiming at

- Provide access to spatial data via **network services** and according to a harmonised data specification to achieve **interoperability of data**
- ! Datasets used in Member States may stay as they are
- ! Data or service providers have to provide a transformation between their internal data model and the harmonised data specification

# Key pillars of data interoperability

## Conceptual data models

- objects types, properties & relationships
- cross-domain harmonization
- based on a common modelling framework
- managed in a common UML repository

## Encoding

- conceptual models independent of concrete encodings
- standard encoding: GML, but also possible to derive other encodings (e.g. based on RDF)

## Harmonised vocabularies

- to overcome interoperability issues caused by free-text and/or multi-lingual content
- allow additional terms from local vocabularies

## Registers

- provide unique and persistent identifiers for reference to resources
- allow their consistent management and versioning

# Key pillars of data interoperability

## Conceptual data models

- objects types, relationships

## Encoding

- conceptual independent

## Harmonised vocabularies

- to overcome interoperability issues caused

## Registers

- provide unambiguous persistent

# described in INSPIRE Conceptual Framework documents



### INSPIRE Generic Conceptual Model

Title	D2.5 Generic Conceptual Model, Version 3.0.nc2
Version	Version for Annex I(II) data specifications (3.0.nc2)
Creator	Drafting Team "Data Specifications"
Date	2013.06.19
Subject	Generic Conceptual Model of the INSPIRE data specifications
Publisher	Drafting Team "Data Specifications"
Type	Text
Description	Generic Conceptual Model of the INSPIRE data specifications
Contributor	Members of the INSPIRE Drafting Team "Data Specifications", INSPIRE Spatial Data Interest Communities & Legally Mandated Organisations, INSPIRE Consultation Teams and other Drafting Teams
Format	MS Word docx
Source	Drafting Team "Data Specifications"
Rights	Public
Identifier	D2_5_L1442.docx
Language	En
Relation	ns
Coverage	Project duration

D2.5: Generic Conceptual Model



### Drafting Team "Data Specifications" Methodology for the development of data specifications

Title	Drafting Team "Data Specifications" – deliverable D2.6 Methodology for the development of data specifications
Version	Baseline version
Creator	INSPIRE Drafting Team "Data Specifications"
Date	2008-09-25
Subject	Methodology for the development of data specifications
Publisher	INSPIRE Drafting Team "Data Specifications"
Type	Text
Description	Proposed methodology for the development of INSPIRE data specifications for the spatial data themes as specified in the Annex of the INSPIRE Directive
Contributor	Members of the INSPIRE Drafting Team "Data Specifications", INSPIRE Spatial Data Interest Communities & Legally Mandated Organisations, INSPIRE Consultation Teams and other Drafting Teams
Format	MS word docx.pdf
Source	Drafting Team "Data Specifications"
Rights	Public
Identifier	D2_6_v3.0.doc, D2_6_v3.0.pdf
Language	En
Relation	ns
Coverage	Project duration

D2.6: Methodology for Specification Development



### Guidelines for the encoding of spatial data

Title	D2.7 Guidelines for the encoding of spatial data
Creator	INSPIRE Drafting Team "Data Specifications"
Date	2009.06.11
Subject	Guidelines for the encoding of spatial data
Publisher	INSPIRE Drafting Team "Data Specifications"
Type	Text
Description	Baseline version of the guidelines for the encoding of spatial data
Contributor	Members of the INSPIRE Drafting Team "Data Specifications", INSPIRE Spatial Data Interest Communities & Legally Mandated Organisations, INSPIRE Consultation Teams and other Drafting Teams
Format	MS Word docx
Source	INSPIRE Drafting Team "Data Specifications"
Rights	Public
Identifier	D2_7_v3.0.doc
Language	En
Relation	ns
Coverage	Project duration

D2.7: Guidelines for Encoding



### D2.9 Guidelines for the use of Observations & Measurements and Sensor Web Enablement related standards in INSPIRE Annex II and III data specification

Title	D2.9 Guidelines for the use of Observations & Measurements and Sensor Web Enablement related standards in INSPIRE Annex II and III data specification
Creator	INSPIRE Core Thematic Working Group on Observations & Measurements
Date	2013.02.04
Subject	Use of Observations & Measurements and Sensor Web Enablement related standards in INSPIRE
Publisher	INSPIRE Core Thematic Working Group on Observations & Measurements
Type	Text
Description	This document describes the use of Observations & Measurements and Sensor Web Enablement related standards in INSPIRE data specification development
Contributor	INSPIRE Core Thematic Working Group on Observations & Measurements
Format	Public
Identifier	D2_9_v3.0.doc
Language	En
Relation	Directorate 2007/2008 of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
Coverage	Project duration

D2.9: O&M Guidelines



### INSPIRE Data Specifications – Base Models – Activity Complex

Title	D2.10.3 Generic Activity Complex
Version	Baseline version
Creator	Drafting Team "Data Specifications", Data Specifications Team
Date	2013.06.20
Subject	INSPIRE Data Specifications – Base Models – Activity Complex
Publisher	Drafting Team "Data Specifications", Data Specifications Team
Type	Text
Description	Baseline version of Base Models of the INSPIRE data specifications
Contributor	Members of the INSPIRE Drafting Team "Data Specifications", INSPIRE Spatial Data Interest Communities & Legally Mandated Organisations, INSPIRE Consultation Teams and other Drafting Teams
Format	MS Word docx
Source	Drafting Team "Data Specifications", Data Specifications Team
Rights	Public
Identifier	D2_10_3_L1442v3.docx
Language	En
Relation	ns
Coverage	Project duration

D2.10.3: Common data models

# Conclusions

- Through INSPIRE, public sector data will become available and interoperable over the next years for 34 spatial data themes
- INSPIRE provides a comprehensive framework for interoperability of spatial data
- Methods and infrastructure components can be re-used for data interoperability in other sectors
- INSPIRE data can be combined with other data to enable cross-sector & cross-border “location-aware” analyses

## Next steps

- Pilots for e-Reporting (e.g. air quality)
  - Using INSPIRE for enabling access to comparable near-real-time air quality information
- Re-usable INSPIRE reference platform **ARe<sup>3</sup>NA**
  - Identify gaps and help sharing re-usable components
    - e.g. INSPIRE registry (soon available on ISA's JoinUp platform)
- EU Location Framework **EULF**
  - Develop a strategic framework of standards, case studies, guidelines to realise the potential of location information in Europe, based on INSPIRE
  - facilitating a more aligned approach using location information in different policy areas
    - e.g. Integrated Transport, Smart Cities

