
Informing you on ambient air quality
in the Belgian Regions

# INSPIRE compliant e-reporting
## under the air quality directives
## from a member state perspective (Belgium)

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# Content

- Who are we (IRCEL – CELINE) and what do we do?
- What is e-reporting under the AQ-directives?
- Different approaches to e-reporting
  - Static xml (via ETL or custom script)
  - Extending a service (cf app-schema)
  - Extending a service (cf native extension of e.g. SOS)
- Reflection about the progress

# IRCEL – CELINE

**<u>Intergewestelijke</u>** Cel voor het Leefmilieu (IRCEL)

Cellule Interrégionale de l'Environnement (CELINE)

Belgische Interregionale Umweltagentur (IRCEL - CELINE)

Belgian Interregional Environment Agency (IRCEL - CELINE)

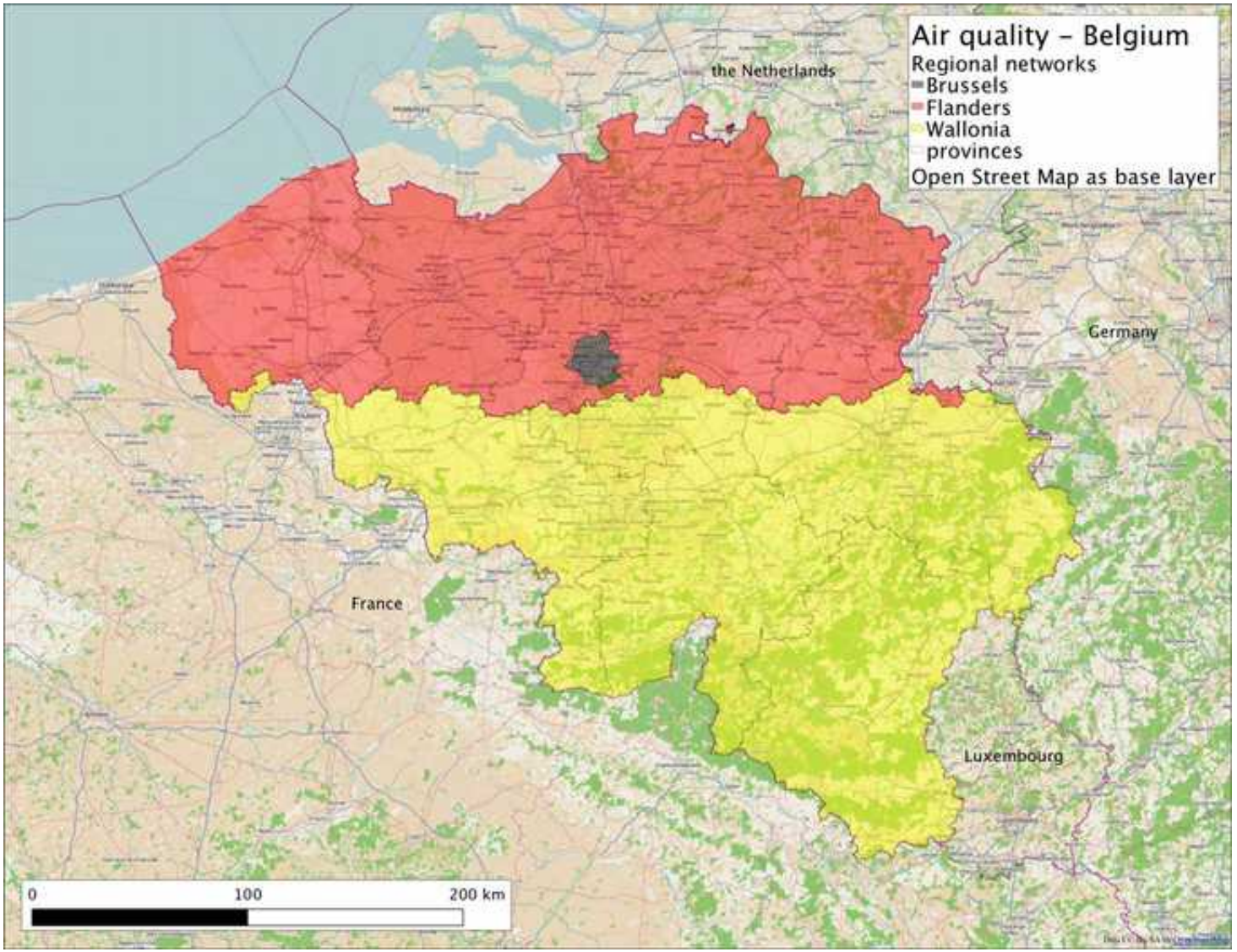
Cooperation agreement between the three Belgian regions

VLAAMSE MILIEUMAATSCHAPPIJ (VMM)

Leefmilieu Brussel - Bruxelles Environnement

Agence wallonne de l'Air et du Climat (AWAC)

# IRCEL – CELINE

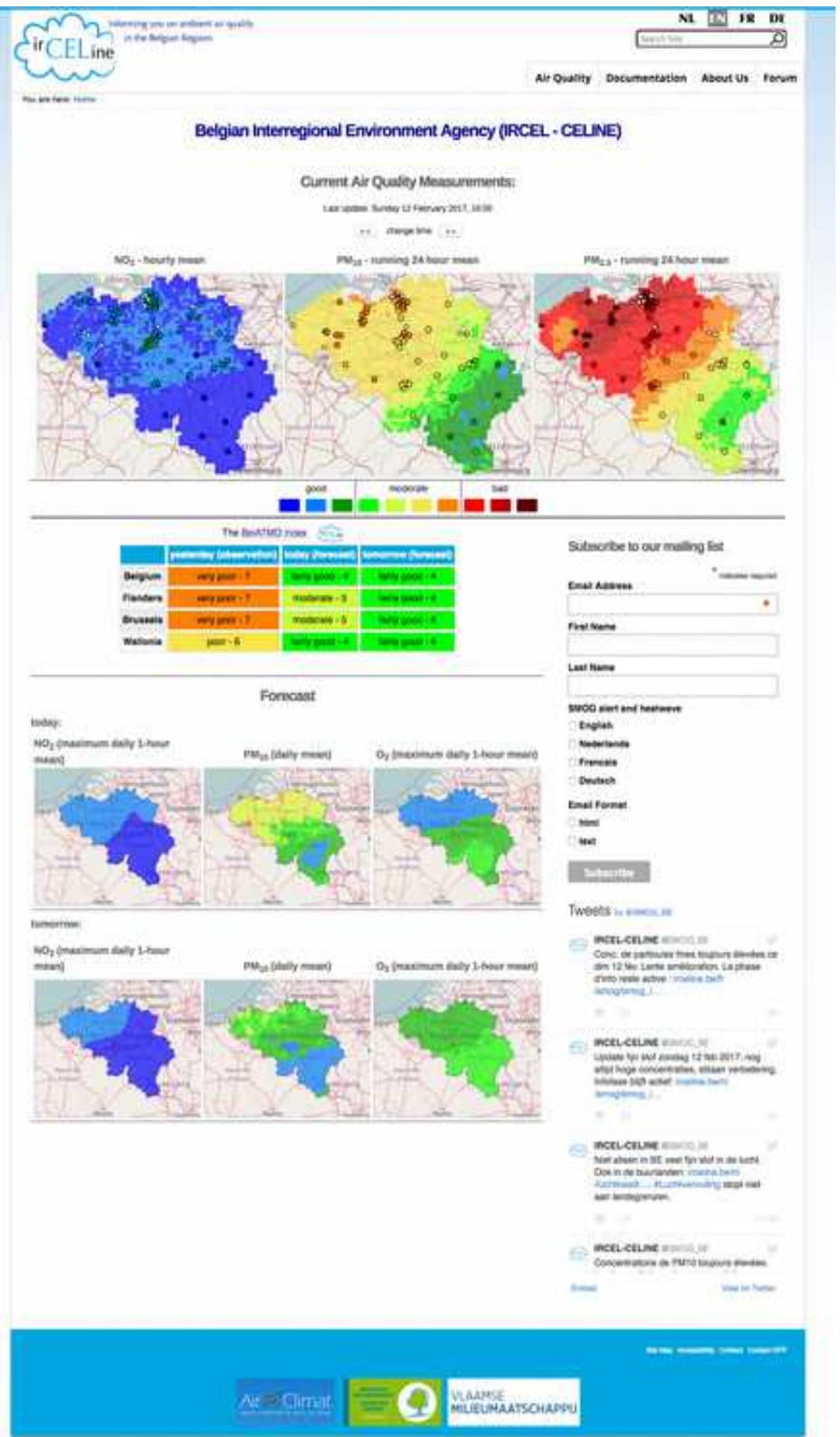



The three Belgian networks

# IRCEL – CELINE


- Most important functions of IRCEL - CELINE (air quality):
  - Continuous forecasts (cf SMOG alert)
  - Informing the public on air quality (real-time and assessment)
  - National report under the air quality directive (2004/107/EC)
  - Enforcing a common scientific basis between monitoring networks
  - Interregional calibration laboratory
  - Interregional data processing centre (IDPC) - real-time database
- National Focal Point (Eionet)
- Compilation GHG inventory

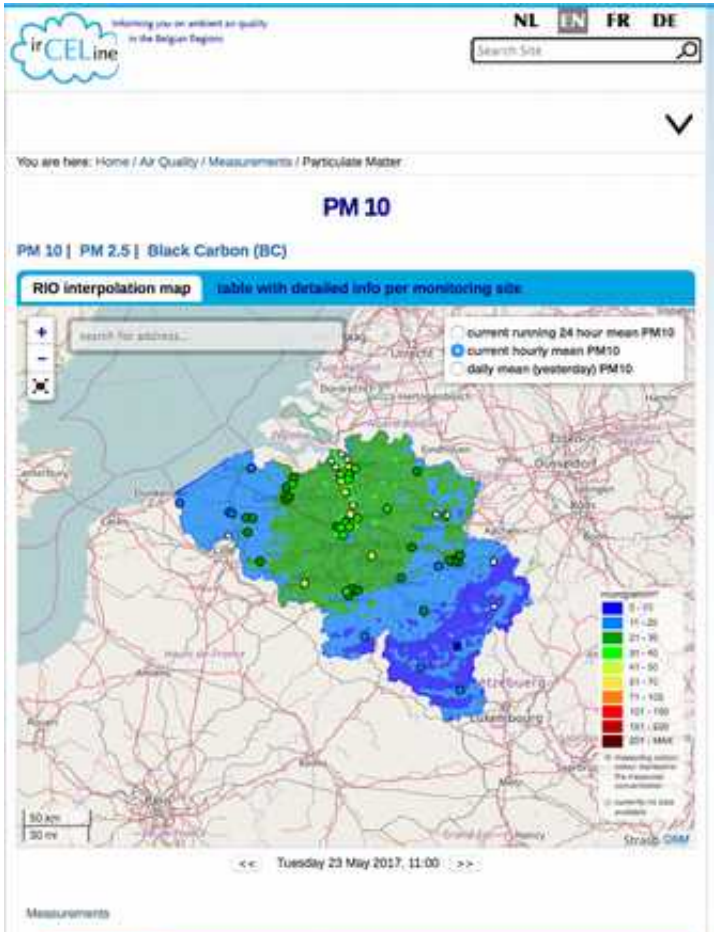
# IRCEL – CELINE



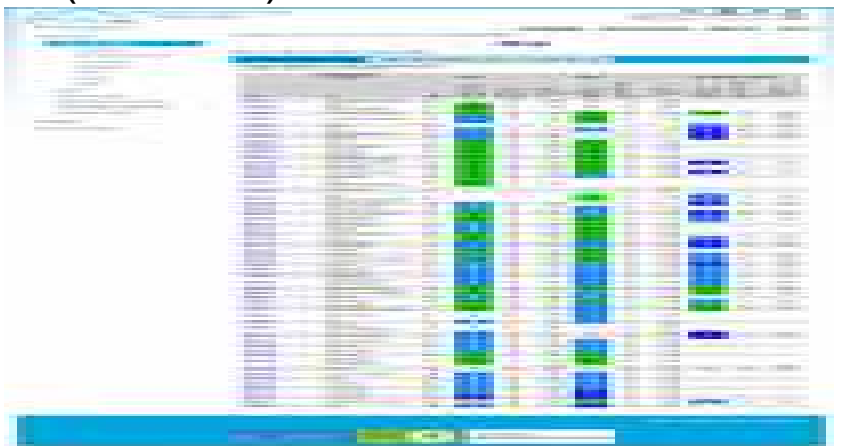

http://www.irceline.be

- Real-time data
- All major pollutants (incl. BC)
- Forecasts
- Information about pollutants
- Publications
- *etc.*

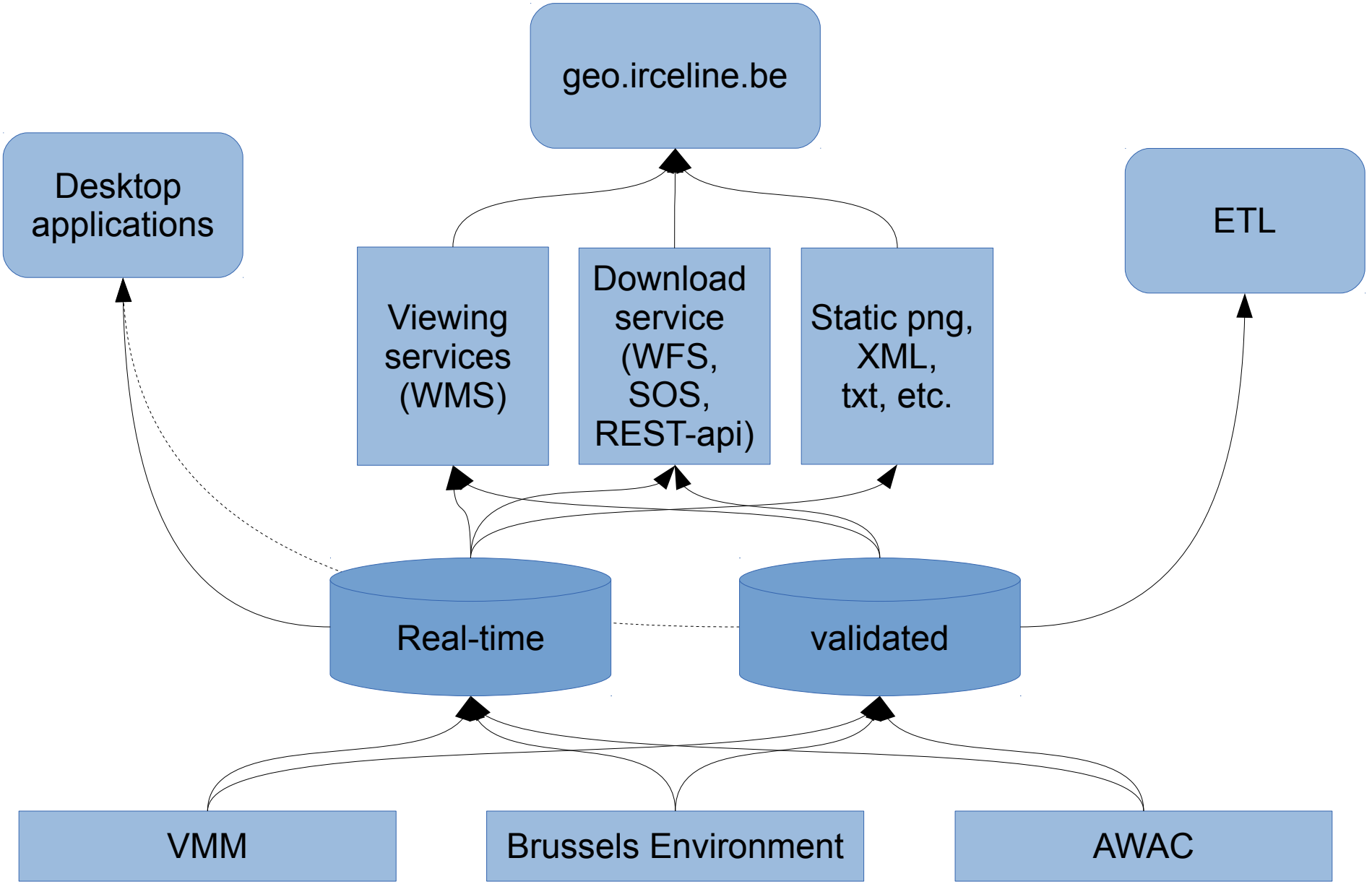
Integration of OGC-services into website




… and tables with (real-time) data:



# Overview SDI @ IRCEL - CELINE



# E-reporting

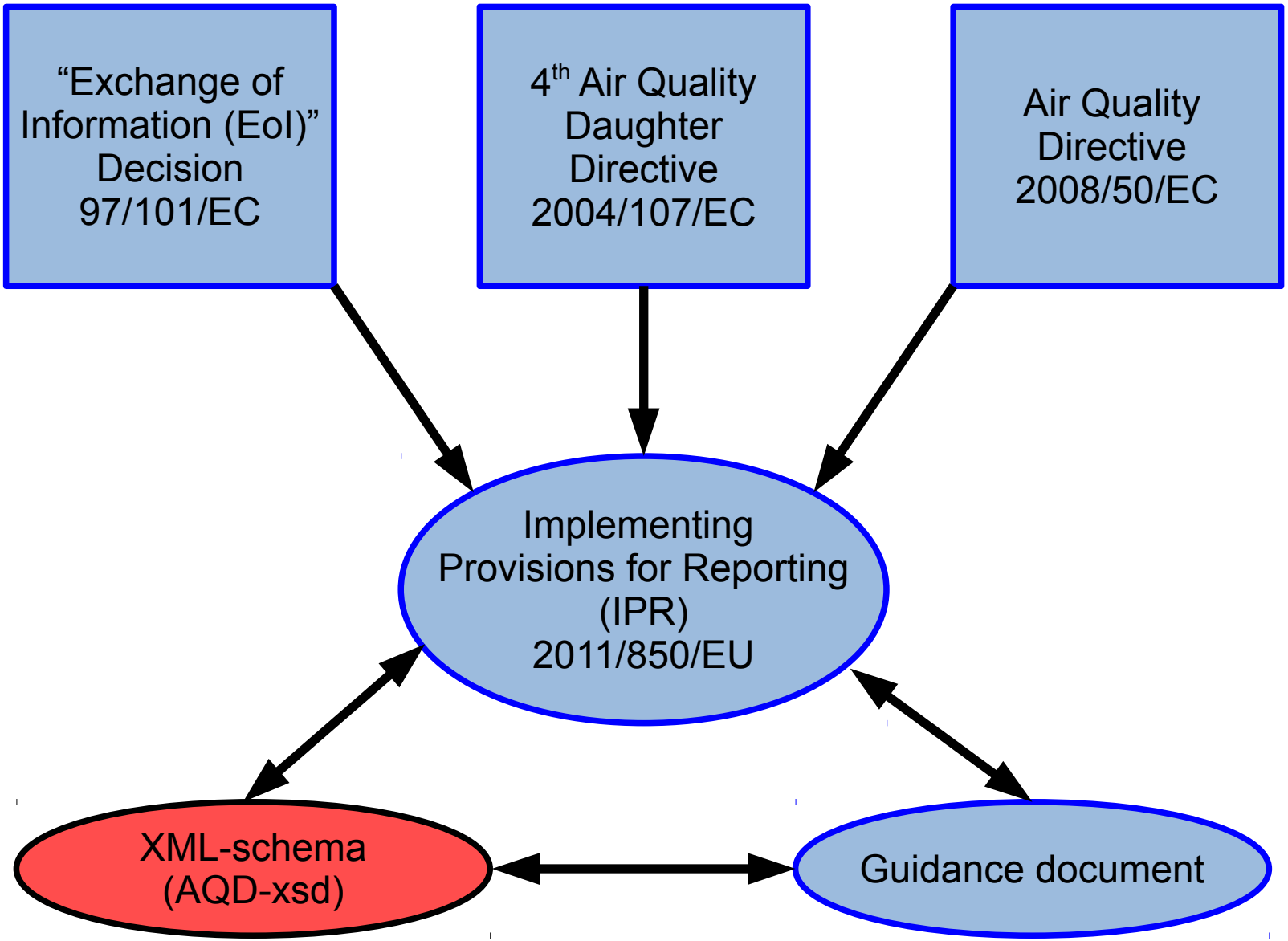
- Operational definition e-reporting:
  - Reporting by means of a standardised, machine-readable data encoding
  - Using a data model defined by a schema (cf INSPIRE data specifications)
  - (Making use of services for reporting - cf INSPIRE specifications for network services - where possible/desirable)
- New Implementing Provisions for Reporting (2011/850/EU) under the Air Quality Directives (2004/107/EC & 2008/50/EC) refer to INSPIRE (preamble, paragraph 7)
- INSPIRE refers to OGC downloading and viewing services, but there is no such thing as an “OGC reporting service”

# The IPR – Decision (2011/850/EU)

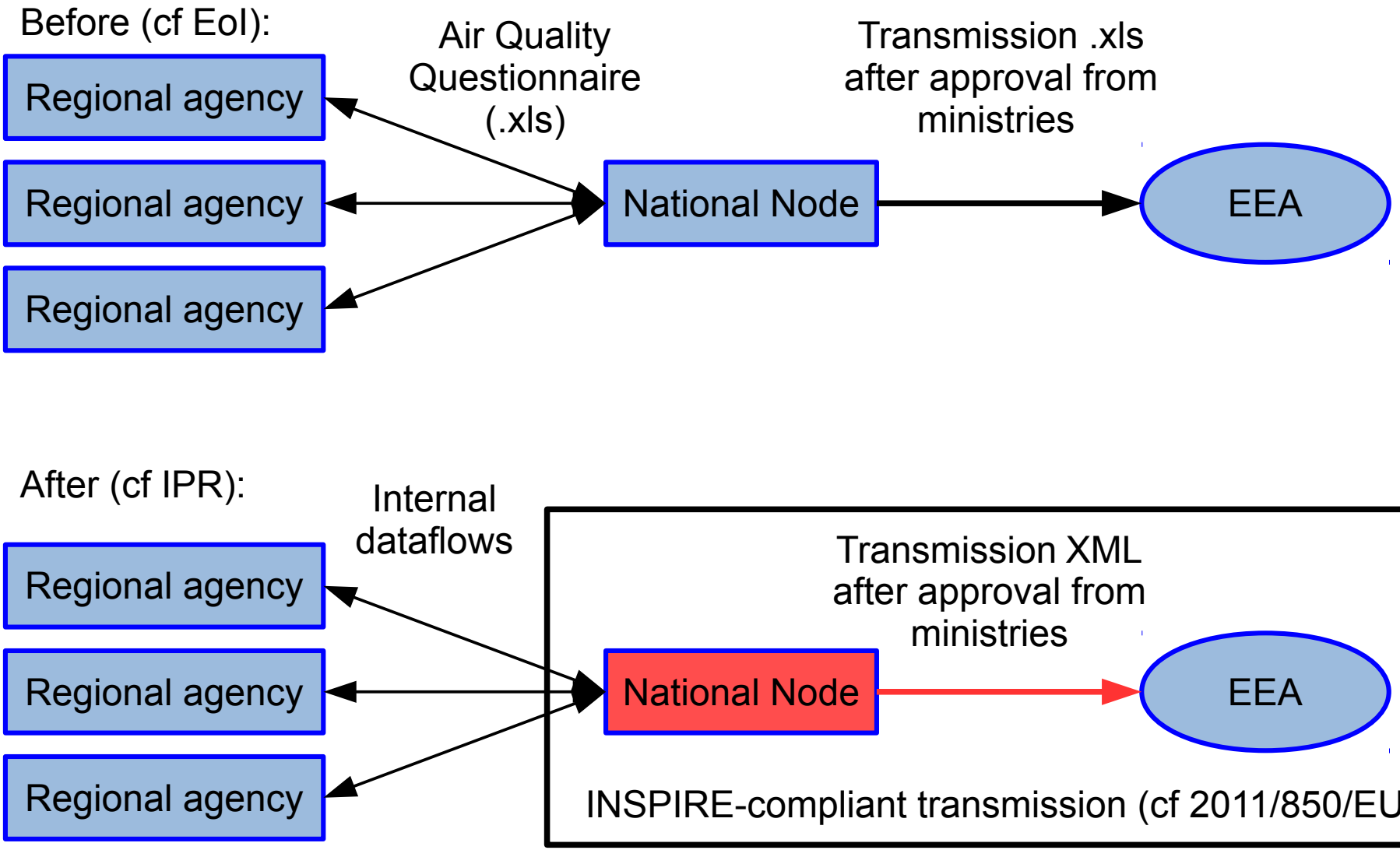
**Preamble, paragraph 7** - To streamline the amount of information made available by Member States, to **maximise the usefulness** of such information and to **reduce the administrative burden**, Member States should be required to make the information available in a **standardised, machine-readable form**. The Commission, assisted by the European Environment Agency, should develop such a standardised machine-readable form **in line with the requirements of Directive 2007/2/EC** of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community **(INSPIRE)** (6). It is of particular importance that the Commission carries out appropriate **consultations** during its preparatory work, including at expert level.

(6) OJ L 108, 25.4.2007, p. 1.

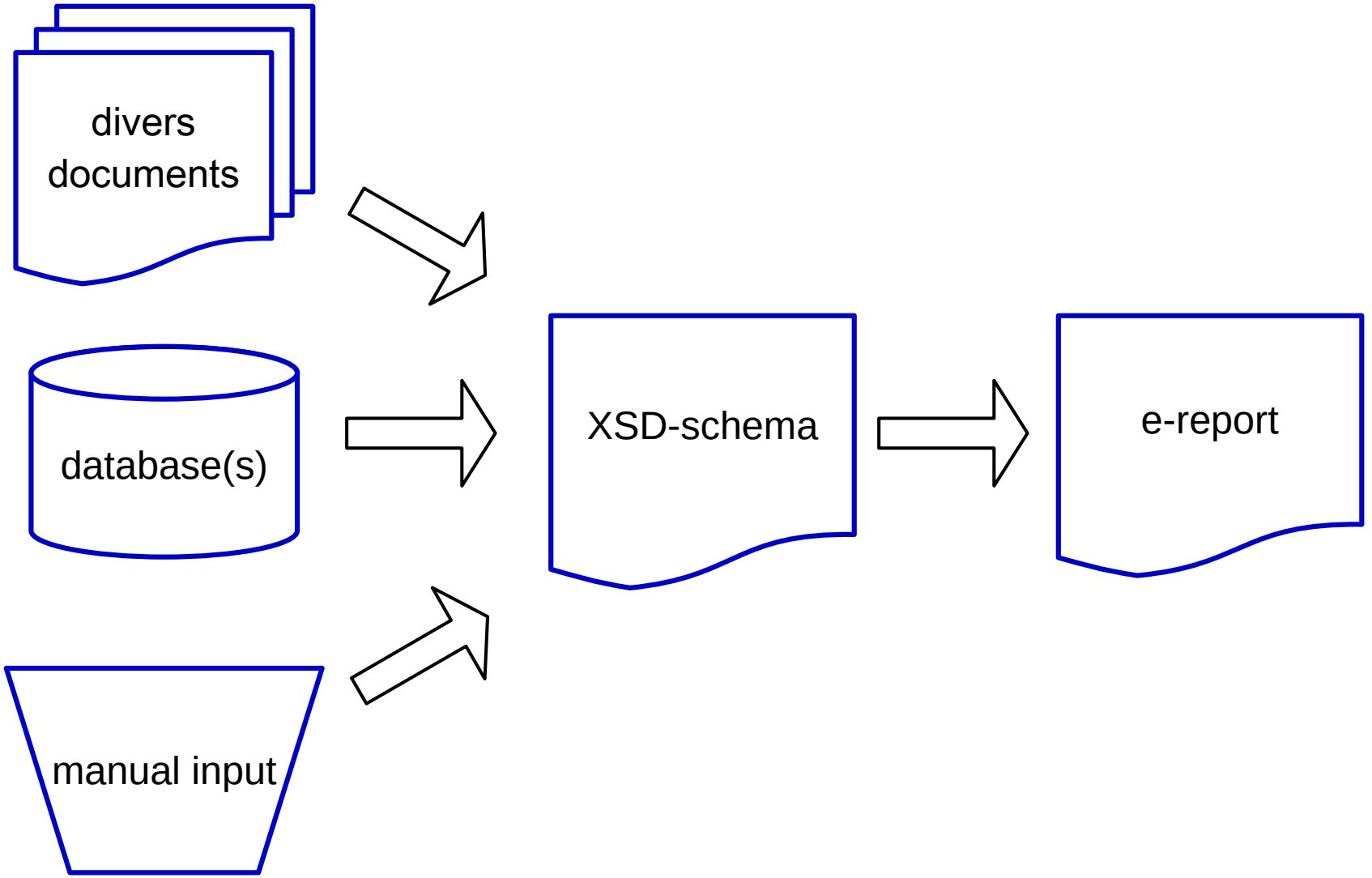
# E-reporting and Air Quality



# E-reporting under the IPR



# E-reporting – schematic representation



# E-reporting: the data flows involved

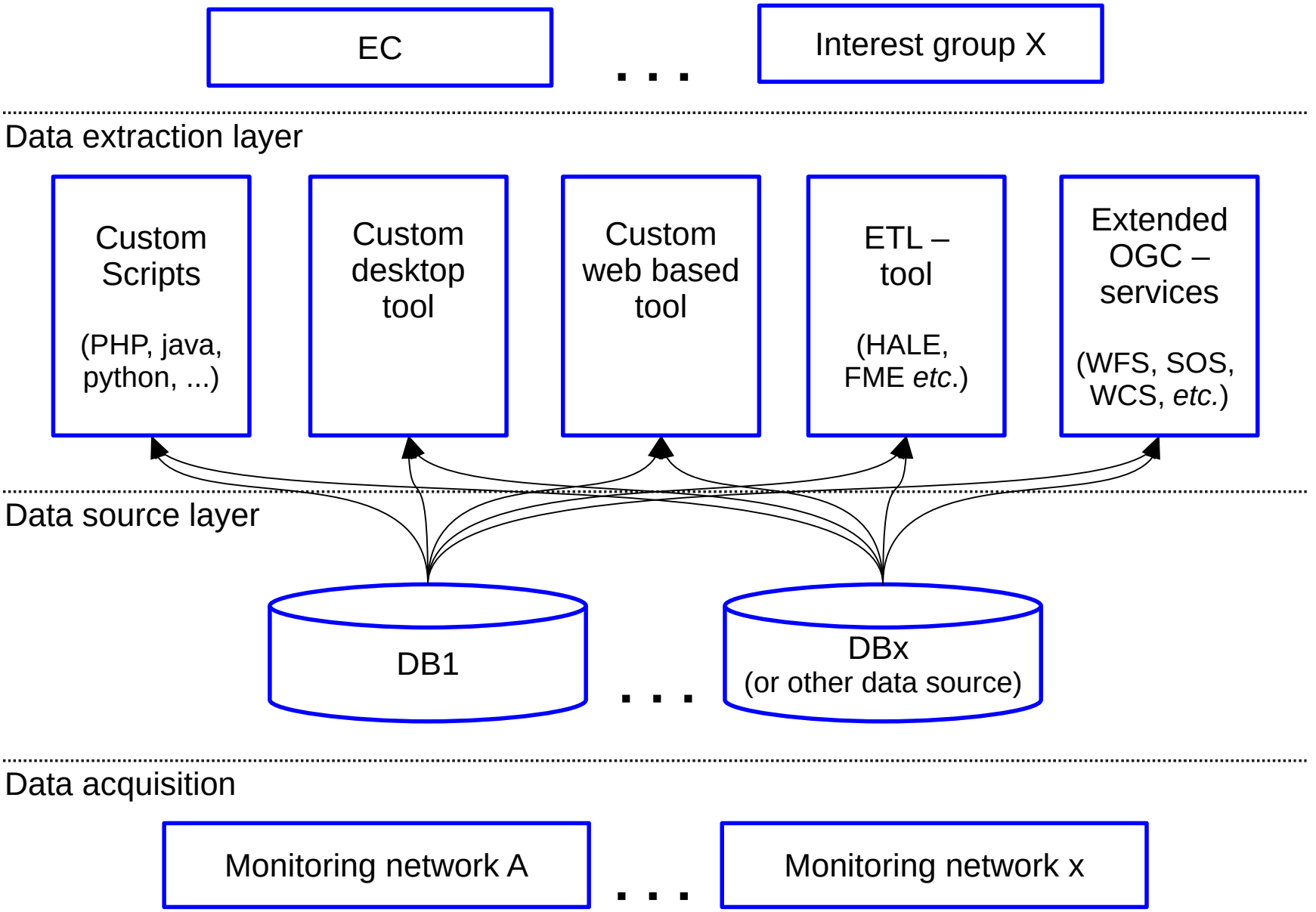
(cf Implementing Provisions for Reporting (IPR) 2011/850/EU)

| INPIRE Data Theme | Content |
|---|---|
| III.11.AM | Dataset B – "zones and agglomerations" |
| III.11.AM | Dataset C – "assessment regime" |
| III.11.AM | Dataset D – "assessment methods" |
| III.7. EF | Dataset E1a – “primary validated assessment data – measurements” |
| III.13 AC | Dataset E1b – “primary validated assessment data – modelled” |
| III.7. EF | Dataset E2a – “primary up-to-date assessment data – measurements” |
| III.13 AC | Dataset E2b – “primary up-to-date assessment data – modelled” |
| III.7. EF | Dataset F1a – “aggregated data - primary validated measurements” |
| III.13 AC | Dataset F1b – “aggregated data - primary validated modelled” |
| III.7. EF | Dataset F2 – “aggregated data - primary up-to-date measurements” |
| III.11.AM | Dataset G – “attainment of environmental objectives” |
| III.11.AM | Dataset H – “air quality plans” |
| III.11.AM | Dataset I – “source apportionment” |
| III.11.AM | Dataset J – “scenario for the attainment year” |
| III.11.AM | Dataset K – "measures" |

+ a header transmitted with every separate submission

colours represent similar data types

# E-reporting: plenty of ways to skin a cat

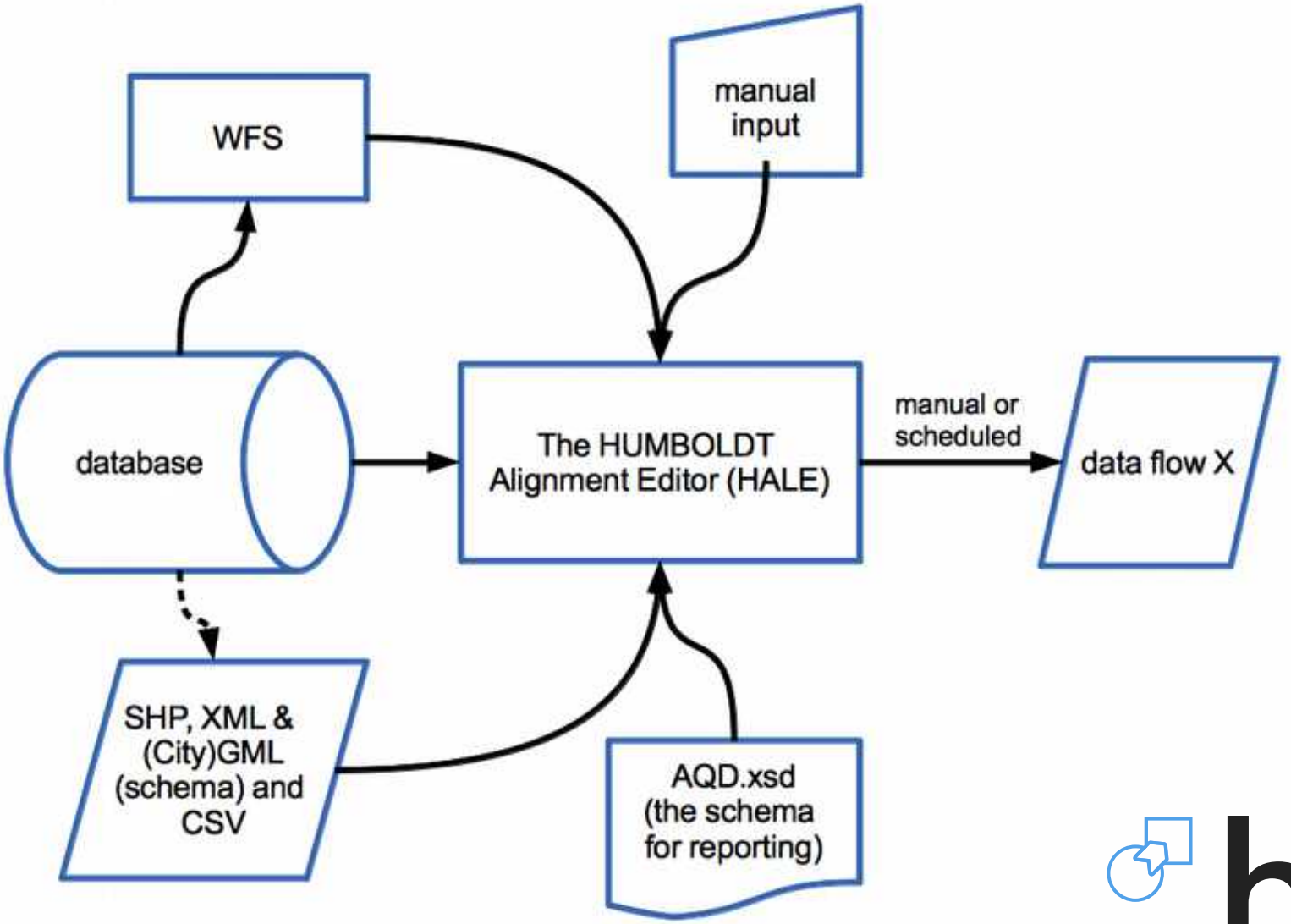


# Different approaches to e-reporting

- Making use of an ETL-tool is probably the most generically applicable method + this can be used as basis for a service
- Custom scripts require specialised skills but produces fast results
- Extending an OGC-service (e.g. SOS or WFS) is most durable solution within a multifunctional Service Oriented Architecture → a queriable dataset

# Generic approach via ETL (using HALE)

ETL = Extract, Transform and Load



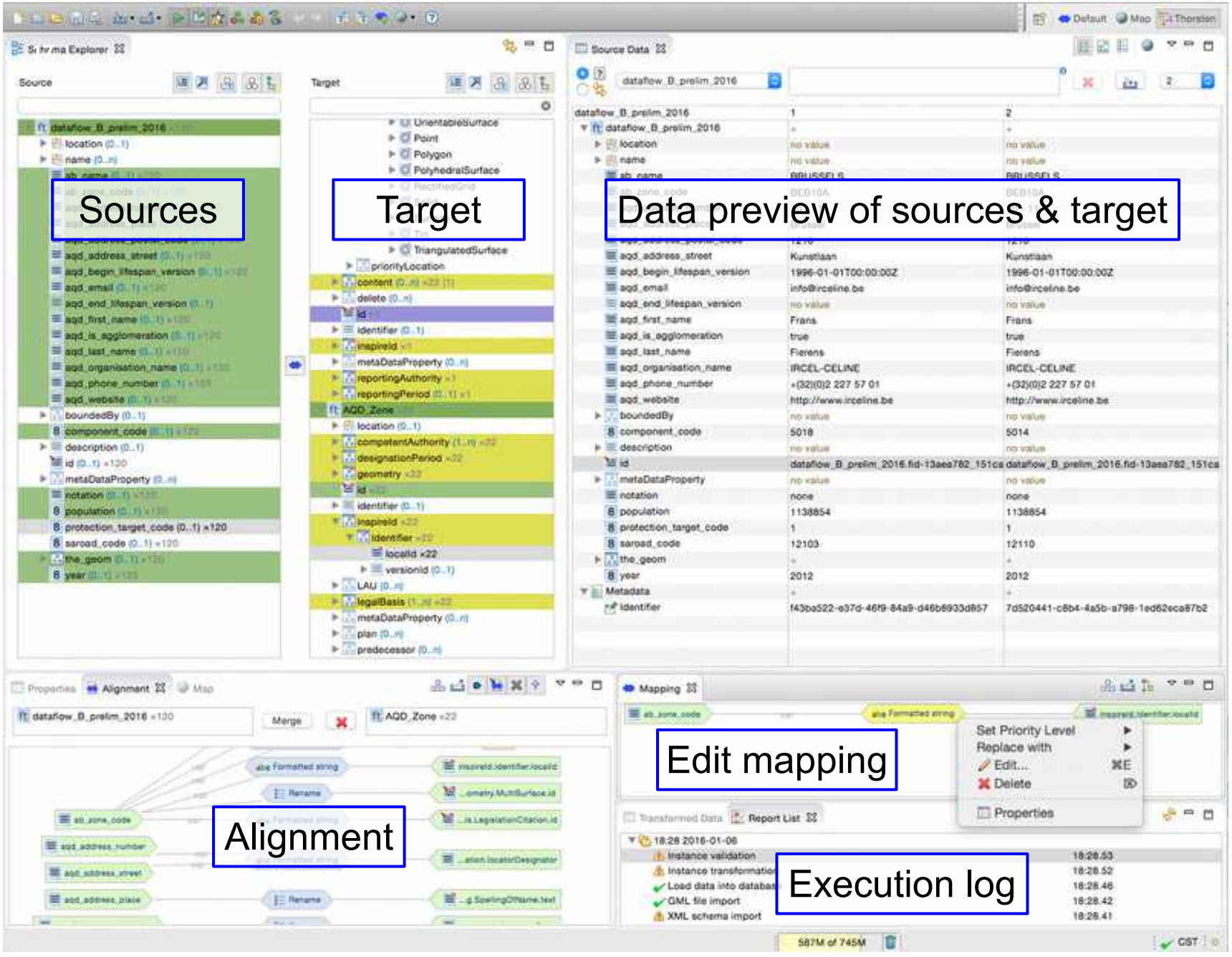

http://www.esdi-community.eu/projects/hale
https://github.com/igd-geo/hale

irCELine

hale STUDIO

# HUMBOLDT Alignment Editor
## - the GUI

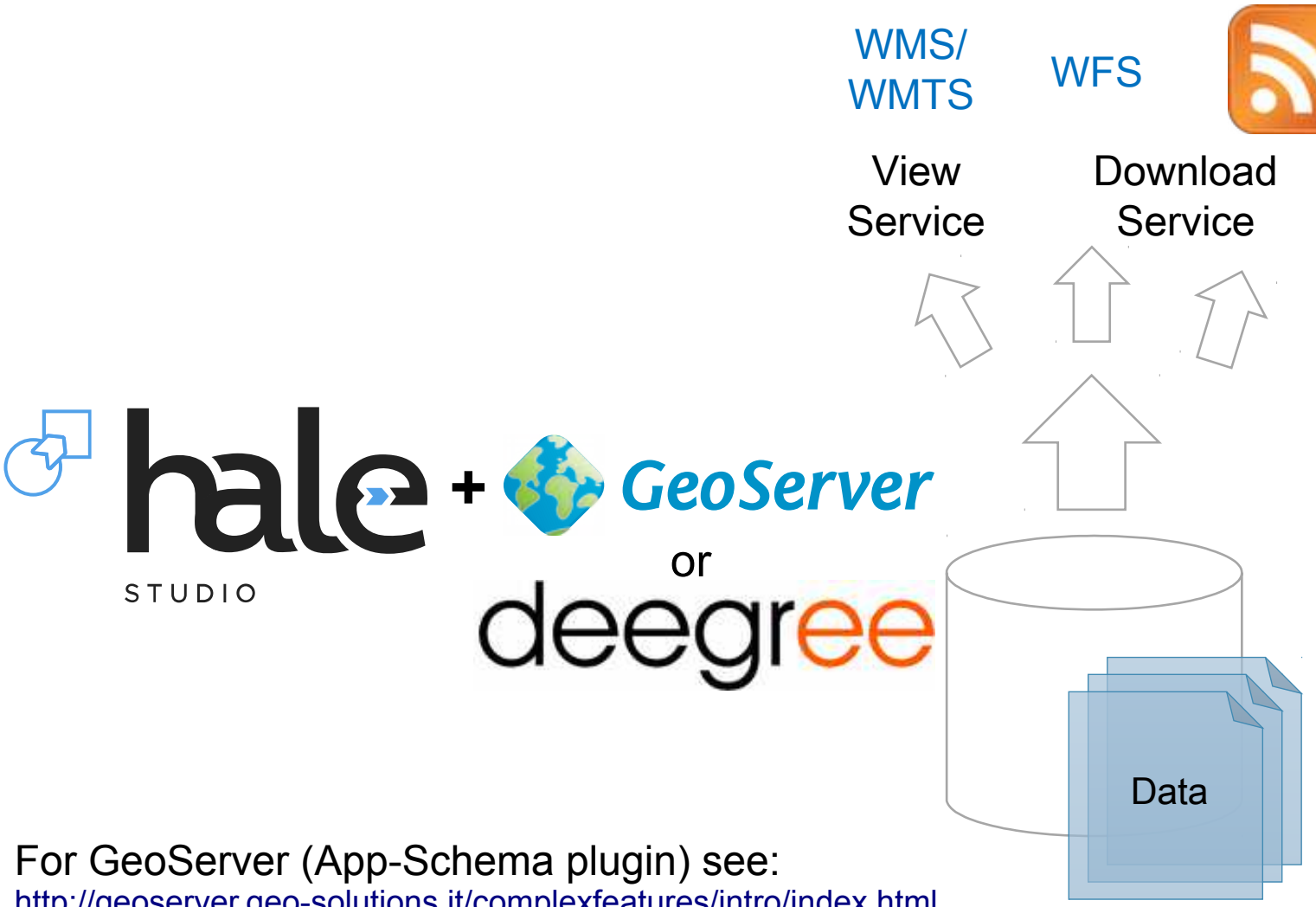
hale STUDIO



# HUMBOLDT Alignment Editor (HALE)

- Intuitive GUI for mapping data from different sources to the schema
- You can execute HALE from the command line (meaning you can do a crontab on Linux), e.g.:
  - [hale@hale ~]$ HALE -nosplash -application de.fhg.igd.hale.fme.app.exec -project <URI-to-project> -source <URI-to-source-data> -out <Path-to-target-file>
- Optional parameters:
  - reportsOut <Path-to-report-file> (Write report of transformation to a file)
  - validate (Enable XML validation)
  - format <format> (Its either 'GML' or 'XML', with 'GML' set as default)
  - root <root-element-name> (The name of the root element to use when using 'XML' as format)
  - root-ns <root-element-namespace> (The namespace of the root element to use if using 'XML' as format)
- HALE can be used as an XSLT-editor
- Can be used to convert a transformation to service (e.g. using GeoServer and the App-Schema or XSLT-plugin)

# From HALE-alignment to (reporting) service




Transformation
(currently limited capabilities,
but under active development)

For GeoServer (App-Schema plugin) see:
http://geoserver.geo-solutions.it/complexfeatures/intro/index.html

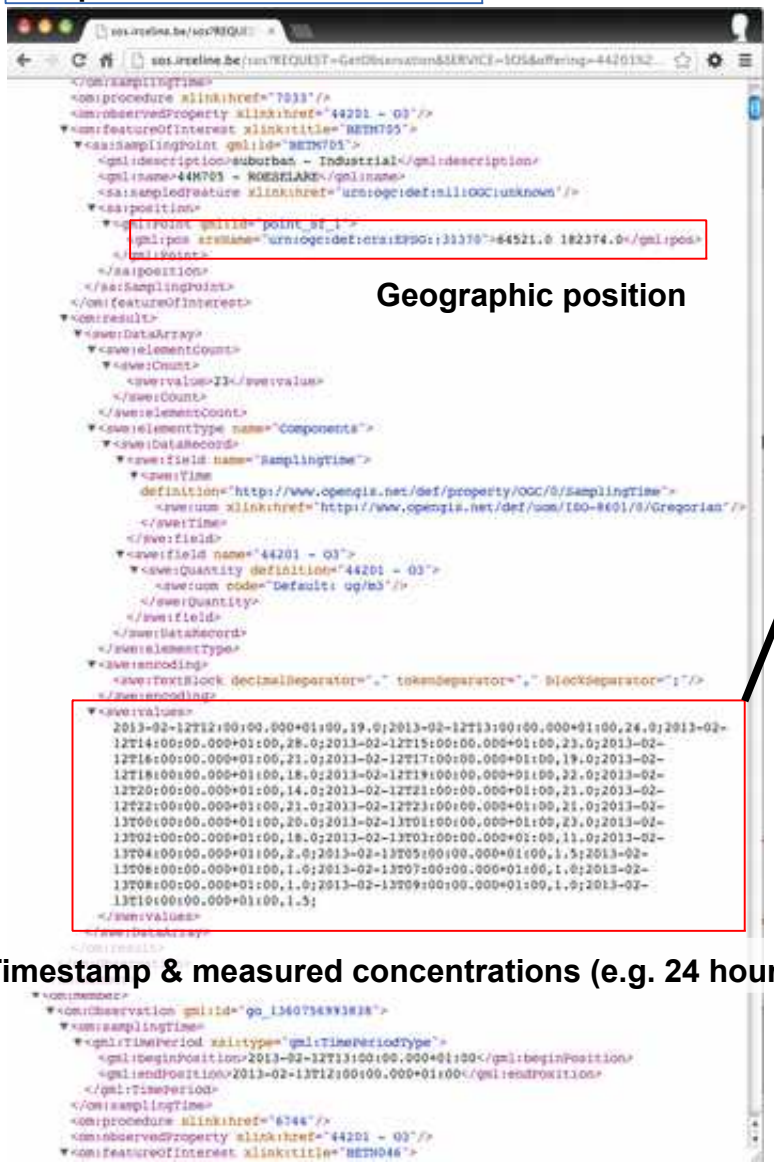
For more information on HALE studio see:
https://www.wetransform.to/

HALE transformation can alternatively also be exported to JDBC database (incl. SpatiaLite, PostGreSQL etc.)

# Sensor observation services (SOS)

… an INSPIRE compliant downloading service

http://sos.irceline.be



Geographic position

Timestamp & measured concentrations (e.g. 24 hours)

- Efficient transmission of time series

```
▼<swe:encoding>
   <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator=";"/>
 </swe:encoding>
▼<swe:values>
   2013-02-12T12:00:00.000+01:00,19.0;2013-02-12T13:00:00.000+01:00,24.0;2013-02-
   12T14:00:00.000+01:00,28.0;2013-02-12T15:00:00.000+01:00,23.0;2013-02-
   12T16:00:00.000+01:00,21.0;2013-02-12T17:00:00.000+01:00,19.0;2013-02-
   12T18:00:00.000+01:00,18.0;2013-02-12T19:00:00.000+01:00,22.0;2013-02-
   12T20:00:00.000+01:00,14.0;2013-02-12T21:00:00.000+01:00,21.0;2013-02-
   12T22:00:00.000+01:00,21.0;2013-02-12T23:00:00.000+01:00,21.0;2013-02-
   13T00:00:00.000+01:00,20.0;2013-02-13T01:00:00.000+01:00,23.0;2013-02-
   13T02:00:00.000+01:00,18.0;2013-02-13T03:00:00.000+01:00,11.0;2013-02-
   13T04:00:00.000+01:00,2
   13T06:00:00.000+01:00,1
   13T08:00:00.000+01:00,1
   13T10:00:00.000+01:00,1
 </swe:values>
```

- queryable:

Extended for e-reporting since version 4.3.x

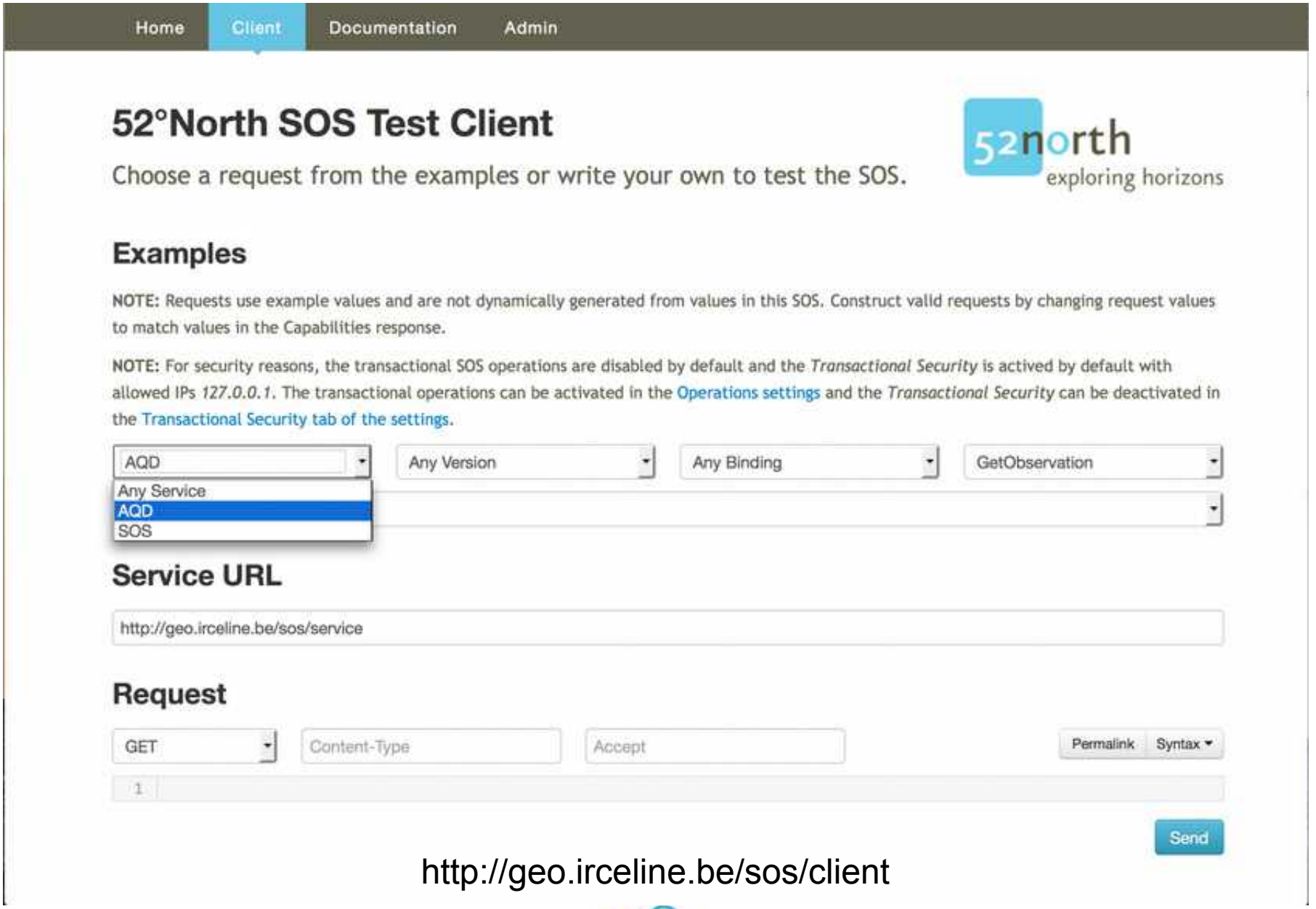
http://viewer.irceline.be

# SOS and the IPR (and INSPIRE)

- The IPR data model expects some extra elements
  - startTime and endTime
  - Validity and verification flag
  - The IPR header
- More convenient to have IPR specific interpretation of standard SOS elements
  - e.g. URI's as pollutant names (also solved with flexible identifiers)
- INSPIRE specifications for downloading services
  - Service has to be able to handle multilingual
  - Return geometry in multiple coordinate systems
  - Some extra metadata elements (extended getCapabilities)

See: https://ies-svn.jrc.ec.europa.eu/projects/download-services-tg/wiki/ARE3NA_SOS_study

# SOS and the IPR (and INSPIRE)



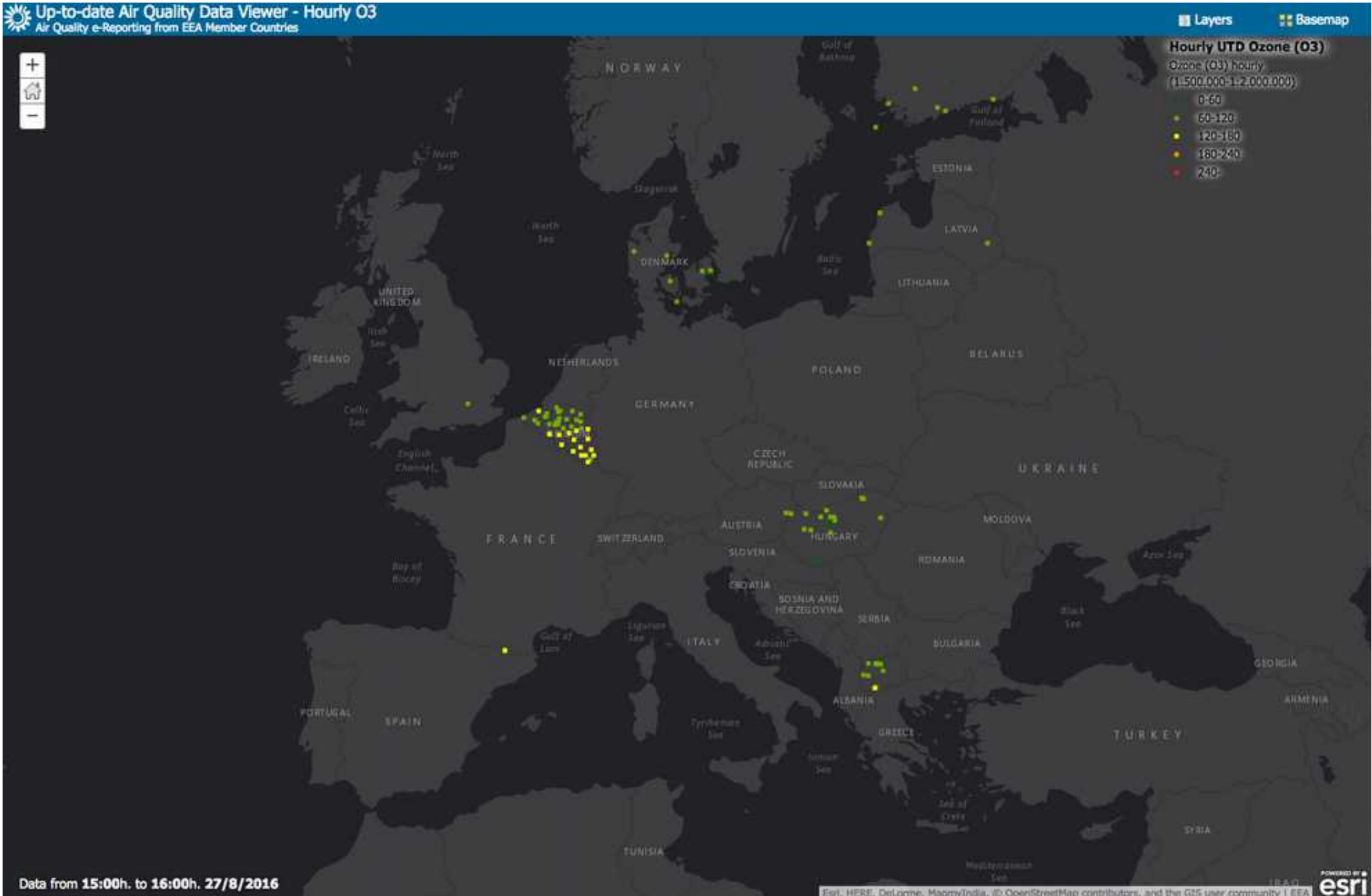

http://geo.irceline.be/sos/client

# Documentation

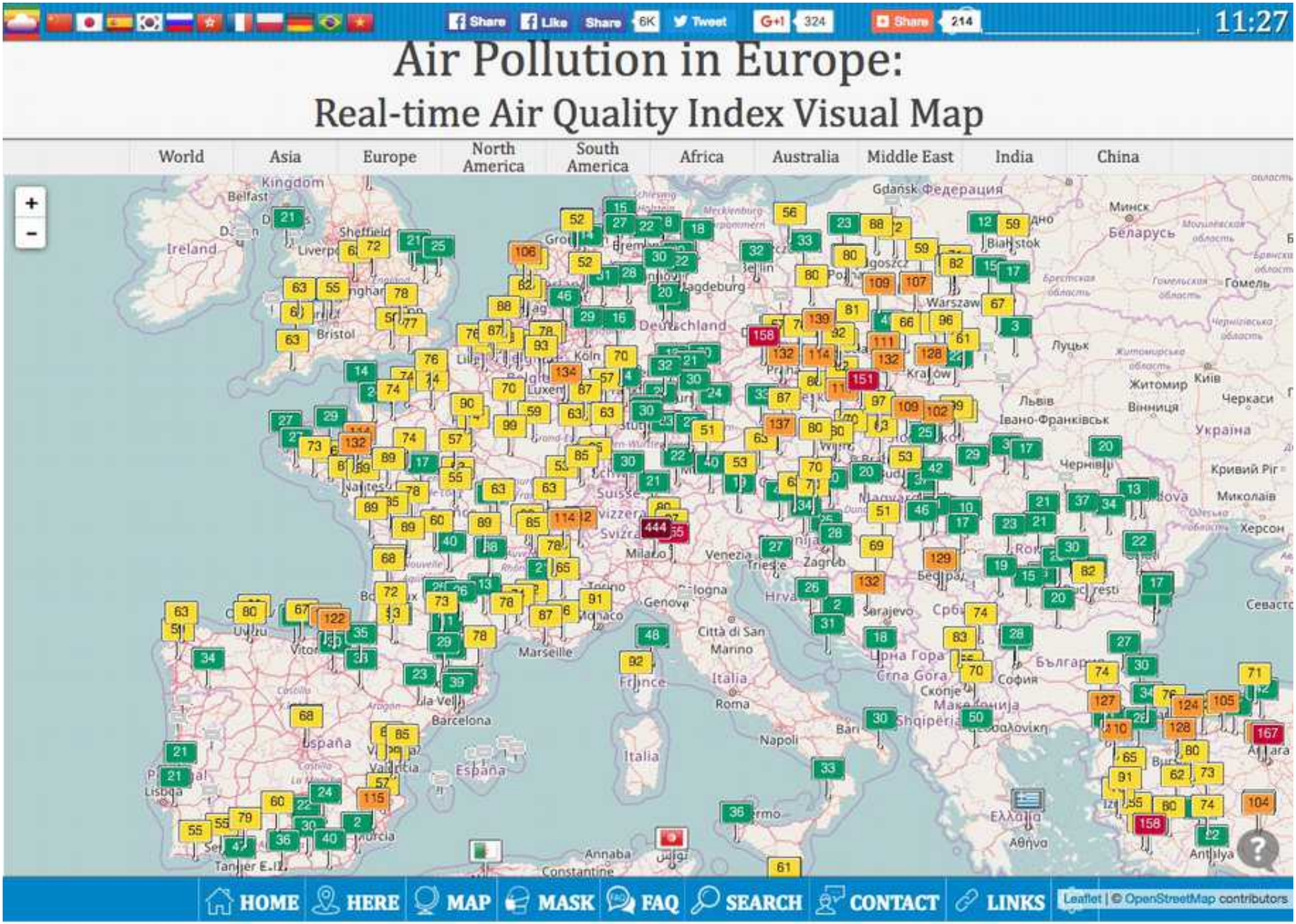
- General documentation SOS server
  - https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation
- INSPIRE Download Service extension
  - https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation#INSPIRE_Download_Service_extensi
- About the additional elements/functionalities for e-reporting
  - https://wiki.52north.org/bin/view/SensorWeb/AqdEReporting
- Flexible identifiers
  - https://wiki.52north.org/bin/view/SensorWeb/FlexibleIdentifier

# Viewer of EU up-to-date data

Data availability during summer-SMOG episode  August 2016

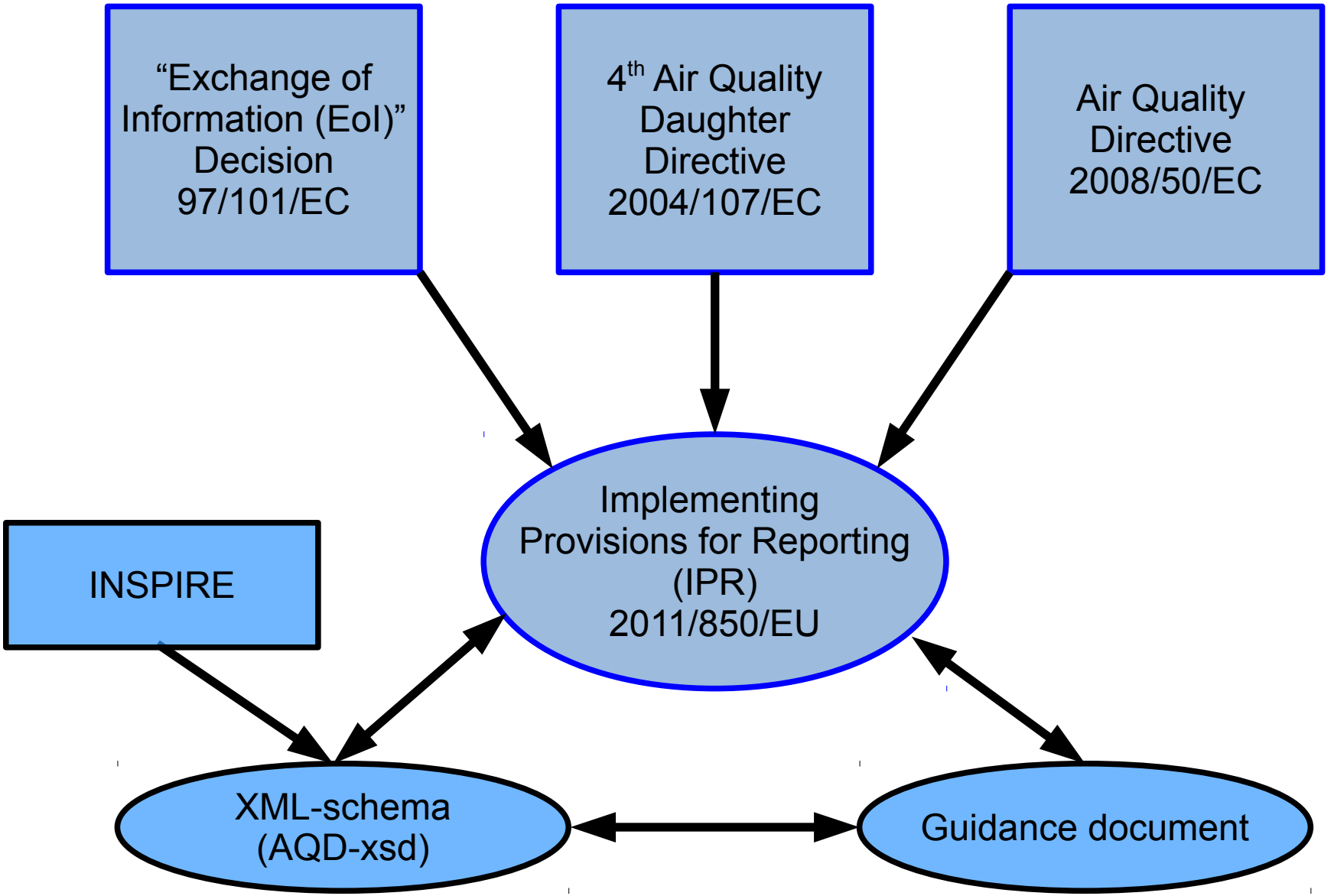


# http://aqicn.org




Share: *"Air Pollution in Europe: Real-time Air Quality Index Visual Map"*

# Where did we go wrong?



# Where did we go wrong?

- The guidance document added a lot of complexity
- INSPIRE view services are performant enough (but left outside the scope of e-reporting)
- INSPIRE downloading service are often not performant enough for big data sets (even if the guidance document would have been less demanding)
- Complexity of the schema for e-reporting under the air quality directives is often blamed on INSPIRE, but this is not entirely fair (cf guidance document & lack of pragmatism during schema design)
- Since a “pull” e-reporting was seen as not in line with legal requirements this possibility was neglected early on in the process → a missed opportunity for leveraging the potential of e-reporting becoming a driver for establishing new SDI’s

# Lesson learned

- Be pragmatic during development schema for reporting
- Think about push versus pull mechanism from the start
- INSPIRE vs open data vs reporting obligations
- Think of alternatives to SOAP/XML (e.g. REST/json)
- XML is very versatile, but not the most efficient data encoding for bigger data sets
- Having a “reporting service” (or OGC download service) for e-reporting creates a queriable, multifunctional dataset
- Progress on data availability can be painstakingly slow (Complications implementing complex data model? Lack of political will?)
- Establish services capable of multiple encodings with focus on efficiency of the data transmission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# Thank you!

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