Interoperable Management of Air Quality Data with ArcGIS Server

Esri European User Conference 2015

Salzburg, 15th October 2015

Christoph Stasch, 52° North GmbH
Simon Jirka, 52° North GmbH
Overview

- e-Reporting of Ambient Air Quality
- Approach
- Server Software
- Visualising and Analysing the Data
- Outlook
e-Reporting of Air Quality

- Reporting of near real-time measurements (and further data) by member states to the European Environmental Agency (EEA)
- Previously: Heterogeneous data delivery processes → significant efforts for integration needed
- Use standards for facilitating data integration → Sensor Web Standards
Sensor Web Overview

Heterogeneous sensor network
- Airborne
- Satellite
- In-Situ monitors
- Surveillance
- Bio/Chem/Rad Detectors
- sparse
- mobile/in-situ
- disparate
- extensible

Models and Simulations
- nested
- national, regional, urban
- adaptable
- data assimilation

Sensor Web Enablement
- discovery
- access
- tasking
- alert notification

web services and encodings based on Open Standards (OGC, ISO, OASIS, IEEE)

Decision Support Tools
- vendor neutral
- extensive
- flexible
- adaptable

Source: OGC 07-165, p. 6
Sensor Web Overview
Sensor Observation Service (SOS)

Provide dynamic Property values

WFS

Provide features of interest

Source: OGC 12-006, p. 147
SOS Operations

• GetCapabilities:
  - Information about
    • Registered sensors, spatial/temporal extent of observations, observed properties, etc.

• DescribeSensor
  - Retrieve descriptions for specific sensors

• GetObservation
  - Query observation data

• Further optional operations:
  - GetFeatureOfInterest, GetResult, ...
e-Reporting of Air Quality

Web Client

EEA

Analysis Tool (e.g. R)

Air Quality Data Country A

Air Quality Data Country B

Air Quality Data Country X
Approach

OGC/ISO Observations & Measurements

OGC Sensor Observation Service

SOS Connector

Web Client

SOS Connector

EEA

SOS Connector

Analysis Tool (e.g. R)

SOS Connector

SOS

Air Quality Data Country A

SOS

Air Quality Data Country B

SOS

Air Quality Data Country C
Approach
Approach

- Define a common data model and format → E-Reporting XML Schemas
  - Based on the ISO/OGC Observations and Measurements standard
- Allow the harvesting of air quality data through a common interface (Web service)
  - Based on the OGC Sensor Observation Service 2.0 interface standard
  - Ensure INSPIRE compliance
- Develop server-side implementations for the use by member states
  - 52° North SOS
  - ArcGIS Server SOS Extension
- Develop client software to consume SOS servers operated by the EEA and its member states
  - EEA import tools (Python scripts, FME)
  - Web clients
  - Analysis tools such as R
ArcGIS Server SOS Extension

- Implements the SOS 2.0 standard
- Extension of ArcGIS Server
- Relies on optimised Microsoft SQL Server database
- Optimised to support the XML schemas for e-Reporting of ambient air quality
- Deployed at EEA for serving the air quality data collected from all member states → allows EEA to distribute the data
ArcGIS Server SOS Extension

SOS + GeoServices REST API

ArcGIS Server

ArcGIS SOS Extension

Map Server

GeoDatabase

Interoperable Management of Air Quality Data with ArcGIS Server
Complementary to ArcGIS Server implementation
Enhance the 52° North SOS 4.x to support the e-Reporting XML schemas for ambient air quality
SOS interface will be used by the EEA to harvest observation data from member states
Support of
- Up-to-date measurements (flow E2a)
- Validated measurements (flow E1a)
Partners
- IRCEL-CELINE (Belgium) → PostgreSQL
- IVL Swedish Environmental Research Institute (Sweden) → MS SQL Server
- RIVM (The Netherlands) → PostgreSQL
- Ricardo-AEA (UK) → MySQL
Visualising the Data

- Example: JavaScript SOS Client
- Functionality:
  - Map view
  - Diagram view
  - Table view
- Responsive design → support of different device types
- Uses the SOS interface to discover and access observation data
- Cooperation of 52° North with IRCEL-CELINE, Wupperverband, University of Leicester
- Available as open source software
- Demo: http://sensorweb.demo.52north.org/jsClient
Visualising the Data
Visualising the Data
Visualising the Data
Conclusion and Outlook

• Conclusion
  - Works operationally
  - Deployed in different types of architectures
  - Increased efficiency to support e-Reporting data flows
  - Added value beyond e-Reporting
  - Further countries are working on supporting the SOS interface

• Outlook
  - Add support for further data flows
    - Information about station networks (Flow D)
  - Extend the community
  - Enhance the data analysis functionality
Thank You for Your Attention!

Further Information:

http://52north.org/
c.stasch@52north.org
jirka@52north.org