Exploiting Observations & Measurement data standard for distributed LTER-Italy freshwater sites. Water quality issues.

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WATERING QUALITY CHALLENGES

- Water quality is a multi-source, multi-purpose problem that needs exploiting observations.
- Many institutions generally perform in situ measurement activities.
- Measures are stored and deployed following heterogeneous practices.

How to SHARE OBSERVATIONS collected from SENSORS

- Open Geospatial Consortium (OGC).
- Sensor Web Enablement (SWE) - interoperability of observations from fixed and mobile sensors.

ISSUES

- Creating SWE basic components, i.e. metadata of sensors and data, plus services for deploying, is not at all, in this moment, an easy task.
EXPERIMENT

To test a methodology and workflow to easy share metadata of the sensors and their measurements of Italian mountain LTER sites, by open GeoWeb Services (OGC standards) and open software tools.

CONTEXT:
“Data-LTER-Mountain”

Architecture:
Federated SDI

Software suite:
GET-IT
DISTRIBUTED ARCHITECTURE

LTER Portal (DEIMS)

Milano
GET-IT
Terrestrial Data Service

From 3 terrestrial LTER sites

Verbania
GET-IT
Lacustrine Data Service

From 4 lacustrine LTER sites

Toward other standard portals (INSPIRE, OGC)
Developed by a joint research group of CNR IREA – ISMAR
It aims to enable researchers to participate in the creation of interoperable Spatial Data Infrastructures (SDI).
By exploiting OGC standards, it enables the interoperable distribution of geospatial data, sensors, measurements, and metadata.
Completely free and open-source.
GET-IT, SOFTWARE INTEGRATION

**GeoNode 2.0**
- GeoServer
- PostgreSQL
- PyCSW

**SOS 52North 4.x**
- PostgreSQL

**GET-IT**
- Metadata extension - EDI Broker
- Map SOS Tool
- Upload Observations Tool
- Explore SOS Tool
- SOS Authentication Proxy

**EDI-NG Client**
- INSPIRE Template
- SensorML Template
Sensors Management

SensorML editing

SOS, GetObservations

SOS end point

URL: http://demo-sk.irea.cnr.it/observation/sos?

SOS, InsertSensor

SOS, GetObservations

SOS, InsertObservation
GET-IT Metadata Editor: EDI (http://edidemo.get-it.it)

Metadata semantically assisted editor customizable through the use of templates.
GET-IT Metadata Editor: EDI (http://edidemo.get-it.it)

A template-driven metadata authoring tool that can be easily customized to any XML-based metadata format and to a specific workgroup, institute, or project. The tool is Free Open Source Software (FOSS) and available under GNU GPL v3.

**RNDT**

Template for Italian repository of territorial data (Repertorio Nazionale dei Dati Territoriali)

**RDF sources:**
- Languages, data types, reference system codes, responsible party roles, and INSPIRE themes: INSPIRE code lists
- Keywords: Global Change Master Directory Science Keyword variables, P02 NERC vocabulary and EUROVOC
- Responsible parties, points of contact, etc.: FOAF (Friends Of A Friend) graph. In this demo search for the Fellowship of the Ring characters.

**Try It »**

**INSPIRE**

Template for INSPIRE MD

**RDF sources:**
- Languages, data types, reference system codes, responsible party roles, and INSPIRE themes: INSPIRE code lists
- Keywords: Global Change Master Directory Science Keyword variables, P02 NERC vocabulary and EUROVOC
- Responsible parties, points of contact, etc.: FOAF (Friends Of A Friend) graph. In this demo search for the Fellowship of the Ring characters.

**Try It »**

**SensorML v2.0.0**

Template for SensorML v2.0.0 SOS lightweight profile

**RDF sources:**
- Parameters: P01 and P02 NERC vocabularies
- Units of measure: P06 NERC vocabulary
- Sensor types: P07 NERC vocabulary
- Manufacturers: FOAF (Friends Of A Friend) graph version of Esonet Yellow Pages.
- Operators, and owners: FOAF (Friends Of A Friend) graph. In this demo search for the Fellowship of the Ring characters.

**Try It »**

**SensorML v1.0.1**

Template for SensorML v1.0.1

**RDF sources:**
- Parameters: P01 and P02 NERC vocabularies
- Units of measure: P06 NERC vocabulary
- Sensor types: P07 NERC vocabulary
- Manufacturers: FOAF (Friends Of A Friend) graph version of Esonet Yellow Pages.
- Operators, and owners: FOAF (Friends Of A Friend) graph. In this demo search for the Fellowship of the Ring characters.

**Try It »**
SENSOR MODELING

- Spreadsheet or paper
- XML - SensorML

Sensor

- Identification code
- Sensor type
- Manufacturer
- Operator
- Classification
- Input
- Outputs parameters

EnvThes
Environmental thesaurus
HTTP REQUEST – DESCRIBE SENSOR XML

```xml
<?xml version="1.0"?>
  <ows:procedureDescriptionFormat>http://www.opengis.net/sensorML/1.0.1/swe:procedureDescriptionFormat</ows:procedureDescriptionFormat>
  <ows:SensorDescription>
    <ows:validTime>
      <gml:TimePeriod gml:id="tp_6319DA6ED0D711A915F85A465493522F9C816470">
        <gml:endPosition indeterminatePosition="unknown"/>
      </gml:TimePeriod>
    </ows:validTime>
      <gs:Sensor id="ISE_DX-580IonChromatograph">
        <gs:description>
          Ion chromatograph for cations measurements; with autosampler A550
        </gs:description>
        <gs:name>ISE - DX-500 Ion Chromatograph</gs:name>
        <gs:keywords>
          <gs:keyword>https://edemapache1.unterbundesamt.at/export/USSlerCV_518</gs:keyword>
          <gs:keyword>https://edemapache1.unterbundesamt.at/export/USSlerCV_81</gs:keyword>
          <gs:keyword>http://sp7.irea.cn.it/sensors/sk.ise.cn.it/procedure/DionexCorporation/DX-500/noSerialNumberDeclared/2015042910379863</gs:keyword>
          <gs:keyword>http://www.opengis.net/def/property/OGC/0/PhenomenonTime</gs:keyword>
          <gs:keyword>https://edemapache1.unterbundesamt.at/export/USSlerCV_319</gs:keyword>
        </gs:keywords>
      </gs:Sensor>
    </ows:SensorML>
  </ows:SensorDescription>
</ows:DescribeSensorResponse>
```
DESCRIBE SENSOR – HTML PAGE

**ISE - DX-500 Ion Chromatograph**

- Manufacturer Name: Dionex Corporation
- Model Number: DX-500
- Ion chromatograph for cations measurements; with autosampler AS50

**Parameters**
- Calcium: Unit of measure: mg/l
- Magnesium: Unit of measure: mg/l
- Sodium: Unit of measure: mg/l
- Potassium: Unit of measure: mg/l

**Position**

- ISE - DX-500 Ion Chromatograph
- Position: 45.924391 N, 8.54862 E
- Altitude: 198.0 m asl

**Contact**

- Owner: ISE
- Operator: ISE

**Open Source Geospatial Research & Education Symposium 2016**
OBSERVATION MODELING

Spreadsheet or paper

XML – Observation & Measurement

Observations

- Feature of interest
- Phenomenon time
- Result time
- Procedure
- Observed property
- Values

EnvThes
Environmental thesaurus
SOS OPERATION - INSERT OBSERVATIONS

Insert data

Fill in the data manually or paste them from a spreadsheet, without headings. Please check the order of columns here proposed.

Show accepted date-time formats.

ResultTime
Please check the result time (i.e., the time when the result became available). Change it if different from the last phenomenonTime (default).

phenomenonTime | Calcium | Magnesium | Sodium | Potassium

| 1972-02-02T09:00:00 |      |          |       |       |
| 1972-02-22T09:00:00 |      |          |       |       |
| 1972-03-02T09:00:00 |      |          |       |       |
| 1972-03-20T09:00:00 |      |          |       |       |
| 1972-03-22T09:00:00 |      |          |       |       |
| 1972-05-16T09:00:00 |      |          |       |       |
| 1972-06-26T09:00:00 |      |          |       |       |
| 1972-07-04T09:00:00 |      |          |       |       |
| 1972-07-13T09:00:00 |      |          |       |       |
| 1972-08-25T09:00:00 |      |          |       |       |
| 1972-10-18T09:00:00 |      |          |       |       |
| 1972-11-23T09:00:00 |      |          |       |       |
| 1973-01-15T09:00:00 |      |          |       |       |
| 1973-02-15T09:00:00 |      |          |       |       |
| 1973-04-02T09:00:00 |      |          |       |       |
| 1973-04-05T09:00:00 |      |          |       |       |
| 1973-04-10T09:00:00 |      |          |       |       |
| 1973-04-12T09:00:00 |      |          |       |       |

Legend - Fields definition:

 phenomenonTime (Date and Time)
 Calcium (Quantity) Unit of measure: mg/l
 Magnesium (Quantity) Unit of measure: mg/l
 Sodium (Quantity) Unit of measure: mg/l

save data | reset table
VIEW OBSERVATIONS
RESULTS

- 70 new observations and metadata. Time range variable between fifty and thirty years with a time resolution between monthly and quarterly.

- Researchers can easily create, manage, edit and share sensors metadata and ecological observations of mountain lakes and terrestrial mountain sites based on OGC SWE initiative.

- Dataset distribution in other projects, external to LTER, in an interoperable way.

- Semantic harmonization of output parameters for sensors and measured parameters for observations.

Free and open source

Documentation, code, demo and support
FUTURE WORK

• Improving the capabilities of GET-IT
  • semantic aware graphical user interfaces
  • add, discover and display not only 2D timeseries but also other types of observations which are included in O&M schema

• Development of European LTER infrastructures
  • SDI nodes of a distributed research infrastructure for 162 sites in 22 European countries that will provide data on long-term trends in environmental change.