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Compendium of available standards

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1. Introduction

This deliverable collects a review of the current standards relevant in the water sector and describes the design for a better strategy to promote interoperability. The collection of standards includes a brief description, some applications and some references for each. Additionally it lists previous EU funded projects where standardization issues in the water domain have been addressed.
This compendium is a first step in the Work Package 5 in order to design a strategy to promote the interoperability as the core of the solution for boosting the outcomes of previous EU funded activities to all water involved agents in the context of next tasks designed in this WP5.

2. Standardization

2.1. Motivation

Standardization is one of the main pillars of WaterInnEU and this motivation is in line to relevant European initiatives and directives, i.e.: INSPIRE, WFD, WISE, as well as world initiatives, i.e. GEOSS. These directives are pushing many agents to reach the standardization and interoperability goals. For instance, INSPIRE is focused on openness and interoperability of **spatial data sets** and services, and coordination and measures for monitoring and reporting.

The Standards provide several benefits to the community:

- **Vendor independence**: it evolves a processing environment for commercial use without being constrained to a single vendor's offerings. Also more parties can care for solutions and the same solutions can work on different platforms.
- **Interoperability**: it allows easily replacing components and results by other compatible ones that can be also easily communicated. It allows to understand and to employ the discovered information and tools, whether local or remote.
- **Transparency**: it provides a clear account to comply with legal provisions, audits, security's verification and it helps to increase competitiveness.
- **Avoid data duplication**: data are collected and maintained at the most appropriate place
- **Preservation**: it helps for digital sustainability enabling solutions to be maintained by others different than the initial vendor and there is room for further innovation.
- **Knowledge exchange**: Working on standards development leads to inter-organizational knowledge sharing and exchange between researchers, companies and public bodies.

These benefits result in a more cost efficient and productive environment. The standardization of formats, services and processes will allow for a harmonized water management between different sectors, fragmented areas and scales (local, regional or international). Standardization and promotion of interoperability is the key for increasing the impact of EU funded activities, also in water sector.

Finally, there are relevant differences between joining a standard or a public format API (Application Programming Interface). Sometimes a clearly documented API can help third parties to develop components "compatible" to the API that will be interchangeable. However the key point is in the process of developing the standard or the API: The standards process implies that there is a consensus between some/many actors in the field to use a common standard or protocol. In most cases, the standards are developed collectively, and are tested in interoperability experiments involving different actors before getting approved by a majority. In the other case, someone (single author, a company, institution) develops an API and will expect that others will be willing to use it without any consensus process in the community. Another problem is the risk for the maintenance of the API beyond the initial development. As standards are owned by the community, they can be easily continued by others.

3. Compendium of standards

There are different standardization committees and international organizations relevant for ICT water domain applications: ISO, W3C, IEEE, OSGeo, OASIS, OGC, IETF, etc. (see Table 1 for more information). However most of them are focused on very general purposes of Information and Technologies (IT) scopes. The WaterInnEU approach is focused on OGC standards due to the relevant spatial component in its applications, and also because some of the OGC standards are specific to water issues.

Acronym	Name	Web site
ECMA	European Computer Manufacturers Association	www.ecma-international.org
IEEE	Institute of Electrical and Electronics Engineers	http://www.ieee.org
IETF	Internet Engineering Task Force	https://www.ietf.org
ISO	International Organization for Standardization	http://www.iso.org
OASIS	Organization for the Advancement of Structured Information Standards	http://www.oasis-open.org
OGC	Open Geospatial Consortium	http://www.opengeospatial.org
OSGeo	Open Source Geospatial Foundation	http://www.osgeo.org
W3C	World Wide Web Consortium	http://www.w3c.org

Table 1: International standard organizations related to ICT i/o water domain

3.1. OGC standards

The Open Geospatial Consortium is an international industry consortium of companies, government agencies and universities participating in a consensus process to develop publicly available interface standards.
Some successful examples of OGC standards for general spatial purposes are netCDF, WMS, GML, KML, WPS, etc. Additionally and specific to water domain purposes, the Hydrology Domain Working Group, a joint working group of the World Meteorological Organisation (WMO) and the OGC, seek technical and institutional solutions to describe and exchange data for describing the state and location of water resources.

Next compendium is a selection of OGC standards following the criteria of their common application in water domain or their potential use. There is a short general definition and some interesting water domain examples. Table 2 links to the corresponding web page in the OGC website with the complete information to each standard.

- **GML** – Geography Markup Language (also ISO-19136)

It is an XML grammar for expressing geographical features. GML serves as a modelling language for geographic systems as well as an open interchange format for geographic transactions on the Internet.

- **netCDF** – network Common Data Form

It consists of a standards suite that supports encoding of digital geospatial information representing space/time-varying phenomena. netCDF can be used to communicate and store a wide variety of multidimensional data.

- **OpenMI** – Open Modelling Interface

It defines a linkable component: an engine that has been adapted to provide dynamic data exchange in order to facilitate the simulation of interacting processes, e.g. exchanging data as they run, particularly environmental processes.
Hydrodesktop (Ames *et al.* 2012) is a client side Hydrologic Information System that provides a linkage with integrated modelling systems such as OpenMI. This project is supported by U.S. National Science Foundation and the Consortium of Universities for the Advancement of Hydrologic Sciences (CUAHSI - http://www.cuahsi.org).

- **O&M** - Observations and Measurements

It provides a common model and XML encoding for the exchange of observations and relevant metadata including, for example, spatial and temporal information as well as sensor metadata.

- **OWS** – OGC Web Service Context Document

It allows interchanging a set of services and information resources between applications, with preconfigured parameters that allow the reproduction of the same result for each service in those different applications.

- **SensorML** – Sensor Model Language

It provides a framework within which the geometric, dynamic, and observational characteristics of sensors and sensor systems can be defined (e.g., from simple thermometers to Earth observing satellites). Besides a conceptual model for representing sensor information, SensorML also defines an XML encoding for exchanging the sensor information between different applications.

- **SAS** – Sensor Alert Service

It is an event notification service for determining the nature of offered alerts, the protocols used, and the options to subscribe to specific alert types. For example, sensor data provider can continuously push their data to a SAS and clients can subscribe for certain events, e.g. if a value threshold has been exceeded by data of a certain sensor and will then receive a notification.

- **SES** – Sensor Event Service

The Sensor Event Service (SES) can be seen as the successor of the SAS by offering more complex event filtering mechanisms (e.g. complex filters which are combined basic filters) and support of standardized languages for defining and exchanging event definitions, e.g. the Event Pattern Markup Language (EML). However, the SAS and SES are both no official implementation specifications, but discussion paper and best practice paper. There is currently an ongoing activity in the Publish-Subscribe Working Group at OGC that aims to define common eventing facilities for all OGC services.

- **SOS** - Sensor Observation Service

It defines a Web service interface which allows querying observations, sensor metadata and representations of observed features and retrieving this information in standardized formats, i.e. O&M and SensorML.
Chen et al. (2009) explain and compare different SOS implementations: 52°North, GeoBliki, VAST and Deegree. Also they implement SOS in a pilot case with water observations, it means times of measurements, location of the instruments, water level, accuracy of attribute, and completeness of measurement.
52°North provides an open-source Sensor Web client[1] (see Figure 1) that is applied in the water domain, for example providing observations water level, water temperature or water speed. The providers (servers, see Figure 2) of these data are diverse: Federal Waterways Engineering and Research Institute, Global Runoff Data Centre, etc.

[1] http://sensorweb.demo.52north.org/sensorwebclient-webapp-stable/

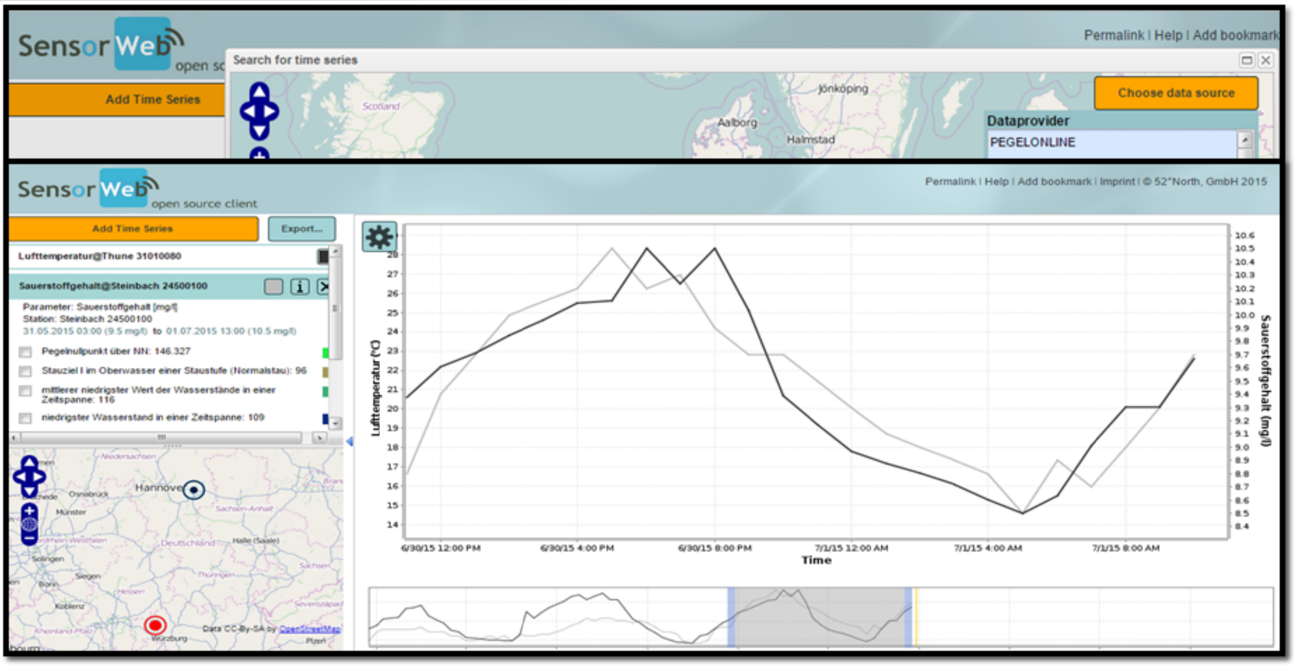
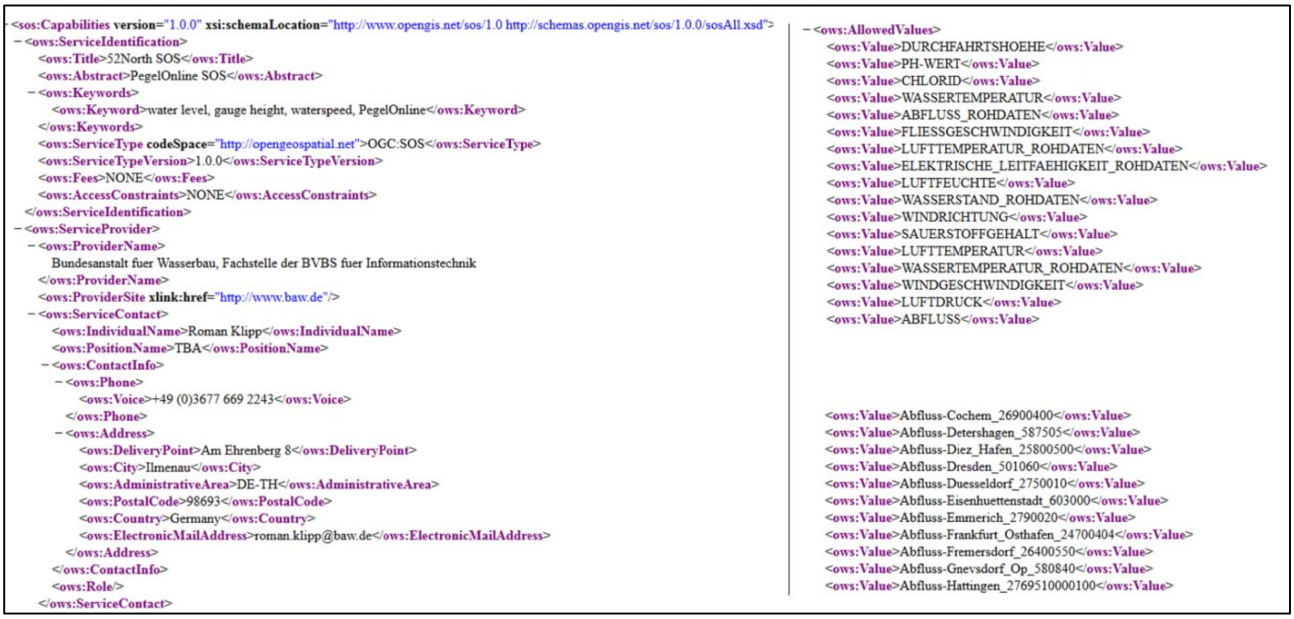


Figure 1: Example of SOS client


<sos:Capabilities version="1.0.0" xsi:schemaLocation="http://www.opengis.net/sos/1.0 http://schemas.opengis.net/sos/1.0.0/sosAll.xsd">
- <ows:ServiceIdentification>
<ows:Title>52North SOS</ows:Title>
<ows:Abstract>PegelOnline SOS</ows:Abstract>
- <ows:Keywords>
<ows:Keyword>water level, gauge height, waterspeed, PegelOnline</ows:Keyword>
</ows:Keywords>
<ows:ServiceType codeSpace="http://opengeospatial.net">OGC:SOS</ows:ServiceType>
<ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
<ows:Fees>NONE</ows:Fees>
<ows:AccessConstraints>NONE</ows:AccessConstraints>
</ows:ServiceIdentification>
- <ows:ServiceProvider>
- <ows:ProviderName>
Bundesanstalt fuer Wasserbau, Fachstelle der BVBS fuer Informationstechnik
</ows:ProviderName>
<ows:ProviderSite xlink:href="http://www.baw.de"/>
- <ows:ServiceContact>
<ows:IndividualName>Roman Klipp</ows:IndividualName>
<ows:PositionName>TBA</ows:PositionName>
- <ows:ContactInfo>
- <ows:Phone>
<ows:Voice>+49 (0)3677 669 2243</ows:Voice>
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- <ows:Address>
<ows:DeliveryPoint>Am Ehrenberg 8</ows:DeliveryPoint>
<ows:City>Ilmenau</ows:City>
<ows:AdministrativeArea>DE-TH</ows:AdministrativeArea>
<ows:PostalCode>98693</ows:PostalCode>
<ows:Country>Germany</ows:Country>
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</ows:Address>
</ows:ContactInfo>
</ows:ServiceContact>
- <ows:AllowedValues>
<ows:Value>DURCHFAHRTSHOEHE</ows:Value>
<ows:Value>PH-WERT</ows:Value>
<ows:Value>CHLORID</ows:Value>
<ows:Value>WASSERTEMPERATUR</ows:Value>
<ows:Value>ABFLUSS_ROHDATEN</ows:Value>
<ows:Value>FLIESSGESCHWINDIGKEIT</ows:Value>
<ows:Value>LUFTTEMPERATUR_ROHDATEN</ows:Value>
<ows:Value>ELEKTRISCHE_LEITFAEHIGKEIT_ROHDATEN</ows:Value>
<ows:Value>LUFTFEUCHTE</ows:Value>
<ows:Value>WASSERSTAND_ROHDATEN</ows:Value>
<ows:Value>WINDRICHTUNG</ows:Value>
<ows:Value>SAUERSTOFFGEHALT</ows:Value>
<ows:Value>LUFTTEMPERATUR</ows:Value>
<ows:Value>WASSERTEMPERATUR_ROHDATEN</ows:Value>
<ows:Value>WINDGESCHWINDIGKEIT</ows:Value>
<ows:Value>LUFTDRUCK</ows:Value>
<ows:Value>ABFLUSS</ows:Value>
<ows:Value>Abfluss-Cochem_26900400</ows:Value>
<ows:Value>Abfluss-Detershagen_587505</ows:Value>
<ows:Value>Abfluss-Diez_Hafen_25800500</ows:Value>
<ows:Value>Abfluss-Dresden_501060</ows:Value>
<ows:Value>Abfluss-Duesseldorf_2750010</ows:Value>
<ows:Value>Abfluss-Eisenhuettenstadt_603000</ows:Value>
<ows:Value>Abfluss-Emmerich_2790020</ows:Value>
<ows:Value>Abfluss-Frankfurt_Osthafen_24700404</ows:Value>
<ows:Value>Abfluss-Fremersdorf_26400550</ows:Value>
<ows:Value>Abfluss-Gnevsdorf_Op_580840</ows:Value>
<ows:Value>Abfluss-Hattingen_2769510000100</ows:Value>

Figure 2: Example of data provided by SOS server

- **WaterML** – Water Markup Language

It is a set of standards for exchanging water observation data, mainly hydrometeorological time series, and is implemented as a profile of O&M.
The portal of the Flemish Water managers (http://www.waterinfo.be/) allows accessing to WaterML time series for precipitation datasets, water level, river flows, etc.
An additional interesting example is the WatERP project that implements several management solutions based on WaterML. The 52°North SOS also supports WaterML as an output format for observations.

- **WCS** - Web Coverage Service

It defines a standard interface and operations that enable interoperable access to geospatial grid coverages, such as digital elevation data, remotely sensed images, digital aerial photos, etc. The response to a WCS request includes coverage metadata and an output grid coverage whose pixels are encoded in a specified binary image format (GeoTIFF, NetCDF, etc.).

The Laboratory for Advanced Information Technology and Standards (LAITS), using the NASA HDF-EOS Web GIS Software Suite (NWGISS) is an example of the combination of standards: WCS as a service and netCDF as an encoding (Figure 3).

getCapabilities

http://data.laits.gmu.edu/cgi-bin/tsunami/wcs100?version=1.0.0&service=WCS&request=getCapabilities

describeCoverage

http://data.laits.gmu.edu/cgi-bin/tsunami/wcs100?version=1.0.0&service=WCS&request=describeCoverage

getCoverage (9.6M bytes)

http://data.laits.gmu.edu/cgi-bin/tsunami/wcs100?version=1.0.0&service=WCS&request=getCoverage&coverage=/data4/TSUNAMI/L71131056_05620041229_B10.hdf:Grid:L71131056_05620041229_B10:L71131056_05620041229_B10&crs=EPSG:32647&bbox=23400,534000,267000,747000&resx=300&resy=300&format=netCDF

Figure 3: WCS Service providing netCDF format

Another interesting example in water domain is the European Drought Observatory, that provides different combined drought indicators (from 2012 to 2015 every ten days) as WCS service in gif and GeoTIFF formats with an OWS map visualization, see in figure 4 a categorized list of indicators.

COLOUR	CDI VALUE	DESCRIPTION
WATCH		
RGB: 255 , 255 , 0	1	A relevant precipitation shortage is observed for just 1 month
RGB: 255 , 255 , 1	2	A relevant precipitation shortage is observed
RGB: 255 , 255 , 2	3	A relevant precipitation shortage is observed over more than a year
WARNING		
RGB: 255 , 165 , 0	4	A precipitation shortage comes with a soil moisture anomaly
RGB: 255 , 165 , 1	5	A precipitation shortage comes with a soil moisture anomaly
RGB: 255 , 165 , 2	6	A precipitation shortage comes with a soil moisture anomaly
ALERT		
RGB: 255 , 0 , 0	7	A precipitation shortage and a soil moisture anomaly are accompanied with an anomaly in the vegetation condition
RGB: 255 , 0 , 1	8	A precipitation shortage and a soil moisture anomaly are accompanied with an anomaly in the vegetation condition
RGB: 255 , 0 , 2	9	A precipitation shortage and a soil moisture anomaly are accompanied with an anomaly in the vegetation condition
RGB: 255 , 0 , 3	10	A precipitation shortage and a soil moisture anomaly are accompanied with an anomaly in the vegetation condition
PARTIAL RECOVERY of vegetation		
RGB: 160 , 128 , 0	11	After a drought episode, the meteorological conditions are recovered to normal but not the vegetation conditions
RGB: 160 , 128 , 1	12	After a drought episode, the meteorological conditions are recovered to normal but not the vegetation conditions
FULL RECOVERY of vegetation		
RGB: 245 , 255 , 220	13	Meteorological and vegetation normal conditions are recovered
RGB: 245 , 255 , 221	14	Meteorological and vegetation normal conditions are recovered

Figure 4: European Drought Observatory WCS service

- **WFS** - Web Feature Service (also ISO-19142)

It defines web interface with operations for querying and editing vector geographic features, such as road networks, political boundaries, cadastral data, rivers, coastal lines, etc. In fact, a basic WFS only allows querying or retrieving features and for Transactional WFS, a client can create, delete or update a feature.
The WFS has many applications to general geographical purposes. In the water domain, the implementation by HydroServer is a very interesting example (Khattar and Ames 2014) in combination with WaterML.

- **WPS** - Web Processing Service

It is a standardized interface that defines a standardized Web-based access to geoprocessing functionality as well as rules for standardizing the inputs and outputs (requests and responses) of geospatial processing functionality. WPS exposes its instances via HTTP-GET, HTTP-POST or SOAP internet protocols. WPS defines three operations:

- getCapabilities: it describes the list of available processing functionality in the instance.
- describeProcess: it is a full description of inputs and outputs of a specific geoprocessing functionality, e.g. what parameters are optional or mandatory, default values, etc.
- Execute: it runs a process with provided inputs and returns the corresponding outputs.

Castronova *et al.* 2013 offers a detailed WPS implementation in a hydrologic model, called TOPography-based MODEL (TOPMODEL) in a PyWPS package. A general framework for publishing customized processes as well as standard processing functionality, e.g. provided by GRASS GIS[2], is available as an open source implementation at 52°North[3].

Acronym	Web site
GML	http://www.opengeospatial.org/standards/gml
netCDF	http://www.opengeospatial.org/standards/netcdf
OpenMI	http://www.opengeospatial.org/standards/openmi
OM	http://www.opengeospatial.org/standards/om
OWS	http://www.opengeospatial.org/standards/owc
SensorML	http://www.opengeospatial.org/standards/sensorml
SAS	http://www.opengeospatial.org/projects/initiatives/sasie
SES	https://portal.opengeospatial.org/modules/admin/license_agreement.php?suppressHeaders=0&access_license_id=3&target=http://portal.opengeospatial.org/files/?artifact_id=29576
SOS	http://www.opengeospatial.org/standards/sos
WaterML	http://www.opengeospatial.org/standards/waterml
WCS	http://www.opengeospatial.org/standards/wcs
WFS	http://www.opengeospatial.org/standards/wfs
WPS	http://www.opengeospatial.org/standards/wps

Table 2: Web pages of the complete information corresponding for the selected OGC standards

3.2. Other interesting standards

As explained in previous section, this compendium is focused on OGC standards. However, other (non-OGC) standards are also related to the spatial domain at current state of the art and it is important to include them in this selection.

[2] More information on GRASS GIS can be found at https://grass.osgeo.org/.
[3] More information on the 52°North WPS can be found at http://52north.org/communities/geoprocessing/wps/.

- **GeoJSON** – Geographic JavaScript Object Notation

It is a format for encoding a variety of geographic data structures. It is a specialization of the JSON format for geographic content. A GeoJSON object may represent geometrical features or a collection of features. One working group maintains this standard and OsGEO supports them.

- **GeoTIFF** – Geographic Tagged Image File Format

It is a standard that allows georeferencing information to be embedded within a TIFF file. It is created (Dr. Niles Ritter) and maintained by the NASA Jet Propulsion Laboratory (JPL) and widely supported by OsGEO.

- **ISO-19101** – Geographic information -- Reference model

It defines the framework for standardization in the field of geographic information and sets forth the basic principles by which this standardization takes place.

- **ISO-19115** – Geographic information -- Metadata

It defines the schema required for describing geographic information and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference and distribution of digital geographic data (see the schema in Figure 5)

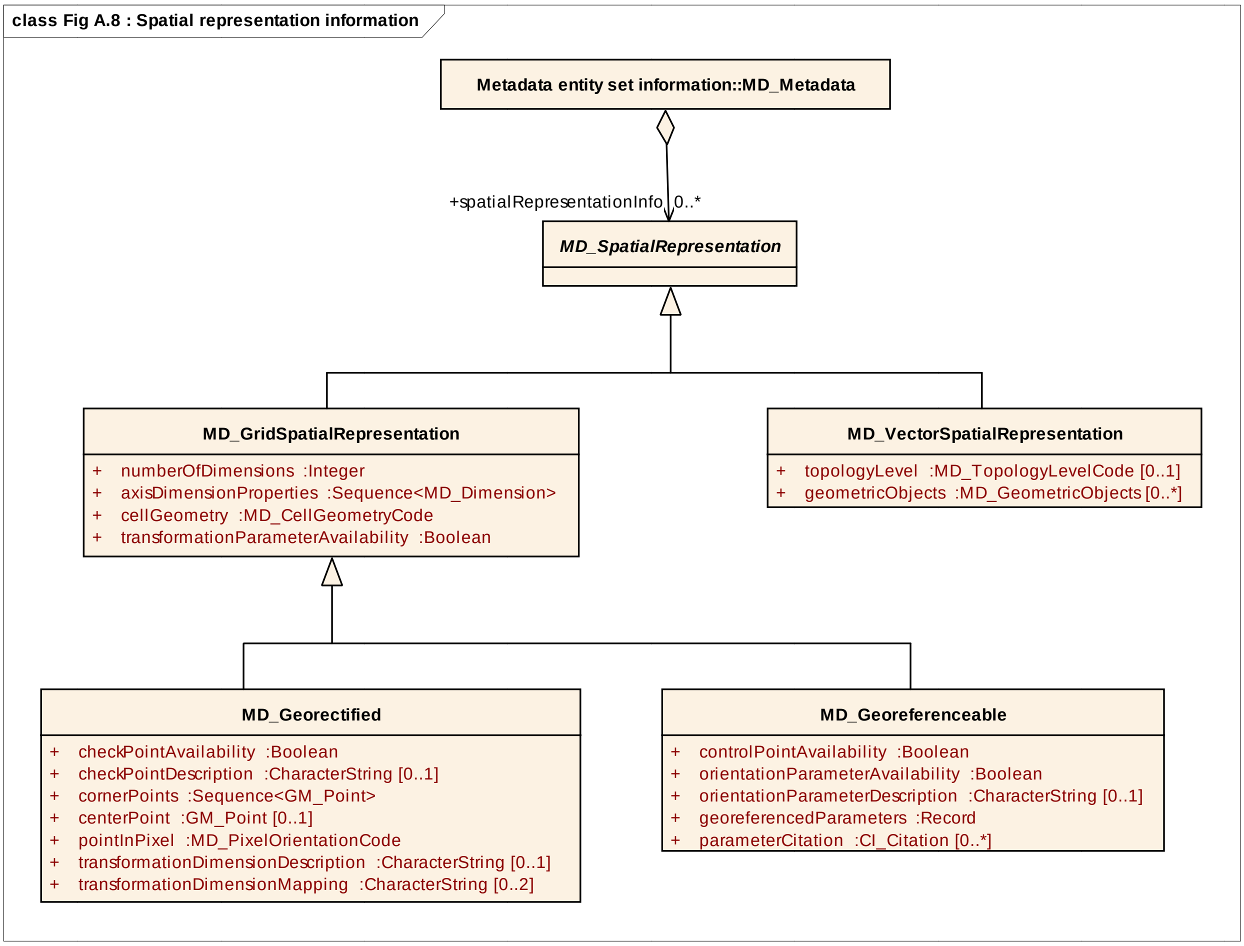

Figure 5: UML for Spatial representation in ISO-19115 (Source: TBD)

- **ISO-19118** – Geographic information -- Encoding

It specifies the requirements to define encoding rules for use and interchange of geographic information data.

- **ISO-19119** – Geographic information -- Services

It identifies and defines the architecture patterns for service interfaces used in geographic information, defines its relationship to the Open Systems Environment model, presents geographic services taxonomy and a list of example geographic services placed in the services taxonomy.

- **ISO-19136** – Geography Markup Language (also OGC-GML)

It is described in the previous section OGC standards as GML.

- **ISO-19139** – Geographic information -- Metadata -- XML schema implementation

It defines Geographic MetaData XML (gmd) encoding, an XML Schema implementation derived from ISO 19115.

- **ISO-19142** – Geographic information -- Web Feature Service

It is described in the previous section OGC standards as WFS.

- **ISO:19156** – Geographic information -- Observations and measurements (also OGC-O&M)

It is described in the previous section OGC standards as O&M.

- **ISO-19162** – Geographic information -- Well-known text representation of coordinate reference systems

It defines the structure and content of a text string implementation of the abstract model for coordinate reference systems.

- IETF - **JSON** – JavaScript Object Notation

It is a lightweight, text-based, language-independent data interchange format. It was derived from the ECMAScript Programming Language Standard. JSON defines a small set of formatting rules for the portable representation of structured data. JSON is built on a collection of name/value pairs (as objects, records, structures, tables, etc.) and with different ways of ordering the relationship between those pairs (arrays, vectors, lists, or sequences).

- W3 - **XML** –eXtensible Markup Language

It defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. It was designed to describe data (HTML for display data) and it is widely used for the representation of arbitrary data structures such as those used in web services.

And finally, it is important to note, that some very used encodings are standards de-facto, although they are not formally standards: SHP, LAS, GPX, CSV, etc... Water tools and models need to consider and work with them in an interoperable way. Most of them are public.

4. Standards in previous EU funded projects

One of the main goals of WaterInnEU is to connect the outcomes developed in previous EU funded activities. Consequently, a review of the research, development and implementation for standards (focused in the list of section 3) in EU funded projects is needed. Below there is a list of the main projects involved in standardization issues:

- **AWARE** http://www.aware-eu.info

It aims at providing and distribution in those drainage basins where snowmelt is a major component of the annual water balance. They implemented the Aware geo-service where their architecture is focused on data delivery and interoperability.

- **EnviroGRIDS** http://www.envirogrids.net

The main aim of the project is to assess water resources in the past, the present and the future, according to different development scenarios. The objective is also to develop datasets that are compatible with the European INSPIRE Directive on spatial data sharing across Europe. The portal http://www.envirogrids.cz/view implemented a SOS client and WPS clients.

- **EuroGEOSS:** http://www.eurogeoss.eu/default.aspx

EuroGEOSS has three strategic areas: Drought, Forestry and Biodiversity. The project established a drought **metadata catalogue** to allow access to resources for drought monitoring. One of the main pillars of EuroGEOSS is the Multi-disciplinary Interoperability concept that requires research in advanced modelling services using multi-scale heterogeneous data sources, and expressing environmental models as geo-processing workflows.

- **FRESHMON** http://www.freshmon.eu

It is a FP7 Copernicus Downstream project that develops a new service line for the frequent provision of Earth Observation based products for water quality monitoring, combining in situ and hydrodynamic modelling components and integrating the information in a GIS. FRESHMON aimed at a robust, interchangeable infrastructure architecture with standardized interfaces and metadata standards (**Harmonization and INSPIRE conformity**).

- **GeoWOW** http://www.geowow.eu/

GEOWOW's challenge was to improve Earth Observation data discovery, accessibility and exploitability, and to evolve the Global Earth Observation System of Systems (GEOSS) for the benefit of all Societal Benefit Areas (SBAs) with particular focus on Weather, Ocean Ecosystems and Water. WP5 works on capacity building strategies within the Water Societal Benefit Area, with emphasis on the ongoing **standardisation activities in the hydrology domain**. To facilitate the exchange of hydrological data, GEOWOW contributes to international standardization processes within the Hydrology Domain Working Group, a joint working group of the Open Geospatial Consortium (OGC) and the World Meteorological Organization (WMO).

- **HarmonIT** http://www.openmi.org/archives/harmonit

The objective of HarmonIT is to develop, implement and prove a European Open Modelling Interface and Environment (**OpenMI**; Blind *et al* 2005, Moore and Tindall 2005) that will simplify the linking of models and hence allow catchment managers to explore the likely outcomes of different policies.

- **ICeWater** http://icewater-project.eu

ICeWater uses wireless sensor networks for water flow monitoring and it provides a decision support system for the water utilities so that supply and demand patterns can be matched in real-time (Fantozzi *et al.* 2014). Its architecture includes **OGC Sensor Web Enablement** (SWE) modules.

- **WatERP** http://www.waterp-fp7.eu

It develops a web-based “Open Management Platform” (OMP) supported by real-time knowledge on water supply and demand, enabling the entire water distribution system to be viewed in an integrated and customized way. The OMP provides to the user inferred information regarding water supplies, flows, water consumption patterns, water losses, distribution efficiency, and water supply and demand forecasts, within a web-based unified framework. This information is stored in a Water Data Warehouse making **use of semantics and common language and open standards** (such as WaterML 2.0) which is defined in the ontology developed to ensure interoperability and maximize usability.

5. Strategy for promoting interoperability

WaterInnEU’s strategy has two main pillars:

- To enhance the exploitation of EU funded ICT models, tools, protocols and policy briefs related to the water domain.
- It is in-line with the European directives such as INSPIRE and then it is focused on the spatial component.

Due to these two main considerations, WaterInnEU strategy will be mainly based on the continuity of standards and interoperable solutions that were started, used or implemented in previous EU funded projects and in OGC standards.

Following the design specified in the Work Plan of WaterInnEU's Description of Action, specifically in work package 5, we will develop an Interoperability Experiment that proposes a test bed for engaging a selection of present compendium in a flood scenario. This selection mainly includes WaterML, SOS, WPS, Sensor Notification Service, WMS and WFS, but it is not restricted to this list (see the deliverable *D5.2 European water interoperability experiment request for participation* for more information). The first participants invited to collaborate in this experiment are partners of projects indicated in section 4.

Finally, the WaterInnEU marketplace will promote interoperability in their whole concept: the WaterInnEU portal (virtual marketplace) will provide explicit information on standards and tools for searching in associated database. Also, the global marketplace concept will support projects and services when interoperability point of view opens new challenges for exploiting the corresponding outcomes.

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7. Acronyms

API	Application Programming Interface
EU	European Union
HTML	HyperText Markup Language
HTTP	Hypertext Transfer Protocol
ICT	Information and Communication Technology
ISO	International Organization for Standardization
INSPIRE	Infrastructure for Spatial Information in Europe
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information System
OGC	Open Geospatial Consortium
SOAP	Simple Object Access Protocol o Protocol
WFD	Water Framework Directive
WISE	Water Information System for Europe