OpenGIS Project Document 12-126:
Activity Plan for an OGC Interoperability Experiment

Title: Hydrology Domain Working Group –
GroundWater Interoperability Experiment 2

Abbreviation: **GW2IE**

SUMMARY

This groundwater interoperability experiment (GW2IE) will develop and test the GroundWater Markup Language 2, by harmonizing and advancing existing modeling initiatives such as: GWML1, relevant EU-INSPIRE models (Geology-hydrogeology, Environmental monitoring facilities), GeoSciML, and others. This IE will produce an engineering report in preparation for movement of the draft GWML2 specification to an OGC data standard subsequent to the GW2IE.

GWML2 is required for the standard transfer of groundwater feature data, including data about water wells, aquifers, and related entities. It is also intended as the *encoding* model for INSPIRE geology-hydrogeology data specification, and as a reference for observations associated with the features.

INITIATOR ORGANIZATIONS

The OGC members that are acting as initiators of the Interoperability Experiment are:

- Natural Resources Canada (NRCan)
- US Geological Survey (USGS)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- European Commission (DG-JRC)

Contact information for these organizations is contained in an Annex.

PARTICIPANT ORGANIZATIONS

The following organizations will be participating in the IE.

- Geology Survey of Canada, Natural Resources of Canada (GSC)
- US Geological Survey (USGS)
- Commonwealth Scientific and Industrial Research Organization (CSIRO)
- European Commission (DG-JRC)
- University of Ballarat (UB)

- Bureau de la Recherche Géologiques et Minières (BRGM)
- Office International de l'Eau (OIEau)
- British Geological Survey (BGS)
- Geological Surveys of Germany (GSG)
- Polish Association for Spatial Information (PASI).
- Polish Geological Institute (PGI)
- International Groundwater Resources Assessment Centre (IGRAC)
- Salzburg University (Z_GIS)

DESCRIPTION

Objectives

The objectives of the GW2IE include:

- Develop GWML2, a GML compatible information model and encoding for groundwater features, from existing international initiatives.

- Prepare an OGC/WMO engineering report with intent to develop it into a data specification subsequent to the IE. The report will include a description of the information model as well as encoding examples and rules, which will also be compatible with the INSPIRE Geology-Hydrogeology data theme. It will include recommendations from implementation and testing, that will also be informative for the INSPIRE Technical Guidelines on Download Services.

Background

OGC data standards essentially delineate two types of information models: those for (1) observations, and (2) features. These models are related in that features host properties that are measured by observations (e.g. temperature is a property of a water body that can be measured at specific locations and times). This relation is often realized by cross-referencing: e.g. observations can refer to their host features, and features can refer to observations made on their properties. For example, the Observations and Measurements (O&M) specification contains a unidirectional relation between an observation and a feature hosting a property, and another unidirectional relation between feature and related observations. In the hydro domain, The HDWG is developing an O&M-based data specification for water time-series observations (WaterML2), but there exist no reciprocal globally recognized feature standard for groundwater. Emerging initiatives for groundwater features are being developed regionally in North America (GWML1), Europe (INSPIRE - Geology-Hydrogeology model), and Australia, and some are GML-based. These initiatives require harmonization for global applicability and to be a natural correlate with WaterML2 and thus also with O&M.

Use Cases

Four use cases are described below, with commercial, scientific, policy and technologic orientations. Use cases 1-3 involve the delivery of specific groundwater features using web services, to satisfy specific requirements. Use case 4 involves the use of the schema as a canonical structure into which heterogeneous groundwater data formats are transformed.

1. **Use Case 1:** Commercial and Public (groundwater supply)

   This use-case involves identifying the location and properties of water wells, to inform drillers and the public about local environmental conditions.

   Features: water wells including rock logs and rock material properties, well construction elements, as well as other abstraction artifacts.

   Services: features are delivered using WFS and WMS (getFeatureInfo).

2. **Use Case 2:** Policy (groundwater resource management)

   This use case involves the delivery of groundwater quantity information required for water management reporting purposes (e.g. EU Water Framework Directive – Groundwater Directive reporting obligation).

   Features: water management units, water budgets, reservoirs, water bodies.

   Services: features are delivered using WFS and WMS (getFeatureInfo)

3. **Use Case 3**: Scientific (groundwater flow modeling)

   This use case involves the delivery of information required to help determine the flow of groundwater within a particular terrain, likely for input into a computational flow modeling software. It involves the delivery of hydrogeologic properties associated with hydrogeologic units (such as key aquifer properties), the delivery of observations related to those units, and information about the related water bodies.

   Features: rock system, groundwater system, groundwater observations, water bodies.

   Services: features are delivered using WFS and WMS (getFeatureInfo), and observations are delivered using SOS and WaterML2.

4. **Use Case 4**: Technologic (groundwater data integration)

   This use case involves using the schema as a canonical structure into which heterogeneous groundwater data formats are transformed.

   Features: all the above.

   Data Formats: tbd.

   Services: NA

Experiments

The GW2IE will attempt to address the following experiments:

- Experiment #1: determine the validity and efficacy of GWML2 instance documents, generated mainly by web services, against use cases 1-3.
- Experiment #2: determine the efficacy of GWML2, by evaluating its suitability as a canonical structure as per use case 4.

TECHNICAL APPROACH

The Technical Approach for this Interoperability Experiment follows existing principles for development of information models as exemplified by GeoSciML and WaterML2 creation.

Experimental Methodology

The methodology involves:

- Development of use-cases.
- Comparison of existing information models.
- Development of a unified GML-UML model.
- Generation of a GML-XML (XSD) schema.
- Development of Schematron constraints
- Development of GML-XML instance documents, from hypothetical and actual data.
- Deployment of WFS, SOS, and WMS utilizing GWML2.
- Evaluation of instance documents against the use-cases.
- Development of an engineering report.

Demonstration Planning

The results of the experiment will be demonstrated by making public the related documents (GML-UML and XML) and by providing a demonstration of the web services at an appropriate OGC meeting.

Specification Development

The primary focus of the GW2IE will be on the development and testing of the GWML2 information model, a GML compatible encoding for groundwater features. Compatibility of GWML2 with the INSPIRE Generic Conceptual Model, and with emerging surface water initiatives by OGC/WMO, will also be taken into account The end result will be an engineering report, in preparation for its migration into a standards specification document subsequent to the GW2IE.

Component Development

The following components will be developed concurrently by the responsible organization(s), to be completed by the execution end date.

Description	Implementor(s)
Use-cases (in this proposal)	All
Comparison document	GSC, JRC
GML-UML EA model	GSC, JRC, PASI, BGS
GML-XML XSD schema	GSC, JRC, PASI, BGS
GML-XML instances	GSC, PASI, BGS
WFS, SOS, WMS deployment	
Use Case 1: Commercial and Public (groundwater supply)	GSC, BRGM
Use Case 2: Policy (groundwater resource management)	PGI, BGS, GSG, JRC
Use Case 3: Scientific (groundwater flow modeling)	GSC, PASI, BGS
Use Case 4: Technologic (groundwater data integration)	GSC, JRC, BRGM
Engineering Report	All

Testing

Testing will involve:

- Evaluation of the GML-UML against GML principles, and the INSPIRE GCM (Generic Conceptual Model);
- Validation of the XSD;
- Evaluation of the functionality of web services;
- Evaluation of instance documents against use-cases.

DELIVERABLES

The documentation listed below will be considered the deliverables for the project.

Documentation

- The documents listed under Component Development will be developed.

Demonstration

- The developed documents will be made available on the HDWG twiki and the OGC portal.
- A live demonstration of the web services will be shown at an appropriate OGC meeting.

SCHEDULE (TENTATIVE)

Startup	
Activity Plan submission:	Aug. 2012
Anticipated OGC Review Board approval: Includes posting for 2 weeks for member comments	Sept. 2012
Execution	
Planned kickoff date (execution start date): Includes 30-day Participation Notification period	Sept. 2012
GWML2 Development	Sept. 2012 – Sept. 2013
Planned end date:	Sept. 2013
Wrap-up and Reporting	
GWML2 Demonstration	Sept 2013
Final document submission	Sept 2013

RESOURCE PLAN

The Initiative Manager and Lead will be Boyan Brodaric (GSC).

The following resources will be available.

Staffing	Each initiating and participating organization will provide adequate staff resources to support their defined responsibilities for the duration of the GW2IE.
Hardware	Initiating organizations will provide hardware as needed to support the GW2IE.
Software	Initiating organizations will provide software as needed to support the GW2IE.
Other Resources	Participants in the GW2IE are self-funded. All expenses incurred in carrying out the GW2IE will be assumed by the participating agencies within their regular line-of-business.

REQUIREMENTS FOR PARTICIPATION

Participants can be Developers or Observers. Developers must be willing make a resource commitment to the development and evaluation of one or more of the components described in the Component Development section. Observers must be willing to provide feedback on some developed component, and can participate in all discussions.

INITIATOR ORGANIZATIONS – CONTACT INFORMATION

Organization Name	**Geological Survey of Canada, Natural Resources Canada**	
Business Contact	*Name*	**Boyan Brodaric**
	Title	Research Scientist
	Street Address	601 Booth St., Ottawa, ON, Canada, K1A 0E9
	Email Address	brodaric@nrcan.gc.ca
	Phone	613-992-3562
	Fax	N/A
Technical Contact	*Name*	**Eric Boisvert**
	Title	Physical Scientist
	Street Address	490, rue de la Couronne, Quebec, QC, Canada G1K 9A9
	Email Address	eric.boisvert@nrcan.gc.ca
	Phone	(418) 654-3705
	Fax	(418) 654-2615

Organization Name	**US Geological Survey**	
Business Contact	*Name*	**Nathaniel Booth**
	Title	IT Specialist
	Street Address	8505 Research Way, Middleton WI 53562
	Email Address	nlbooth@usgs.gov
	Phone	608-821-3822
	Fax	608-821-3817
Technical Contact	*Name*	**Thomas Kunicki**
	Title	IT Specialist
	Street Address	8505 Research Way, Middleton WI 53562
	Email Address	tkunicki@usgs.gov
	Phone	608-821-3851
	Fax	

Organization Name	**Commonwealth Scientific and Industrial Research Organisation**	
Business Contact	*Name*	**David Lemon**
	Title	Research Stream Leader – Water Informatics
	Street Address	Black Mountain Laboratories, Clunies Ross Street, Black Mountain, ACT, 2601
	Email Address	David.Lemon@csiro.au
	Phone	+61 2 6246 5724
	Fax	N/A
Technical Contact	*Name*	**Peter Taylor**
	Title	Research Engineer
	Street Address	Tasmanian ICT Centre, Castray Esplanade, Hobart, TAS, 7000.
	Email Address	Peter.Taylor@csiro.au
	Phone	+61 3 6232 5530
	Fax	N/A

Organization Name	**European Commission, Directorate General – Joint Research Centre**	
Business Contact	*Name*	**Robert Tomas**
	Title	Scientific / Technical Project Officer
	Street Address	Via Enrico Fermi, 2749 I-21027 Ispra (VA) Italia
	Email Address	robert.tomas@jrc.ec.europa.eu
	Phone	+39 0332 78 5426
	Fax	+39 0332 78 6325
Technical Contact	*Name*	**Michael Lutz**
	Title	Scientific / Technical Project Officer
	Street Address	Via Enrico Fermi, 2749 I-21027 Ispra (VA) Italia
	Email Address	michael.lutz@jrc.ec.europa.eu
	Phone	+39 0332 78 6759
	Fax	+39 0332 78 6325
Technical Contact	*Name*	**Chris Schubert**
	Title	Scientific / Technical Project Officer
	Street Address	Via Enrico Fermi, 2749 I-21027 Ispra (VA) Italia
	Email Address	chris.schubert@jrc.ec.europa.eu
	Phone	
	Fax	

PARTICIPANT ORGANIZATIONS - CONTACT INFORMATION

Organization Name	**University of Ballarat**	
Business Contact	*Name*	**Peter Dahlhaus**
	Title	Senior Research Fellow
	Street Address	University Drive, Mount Helen, Vic 3350 Australia
	Email Address	p.dahlhaus@ballarat.edu.au
	Phone	+61 3 5341 3994
	Fax	n/a
Technical Contact	*Name*	**Andrew MacLeod**
	Title	Technical Manager, CeCC
	Street Address	Suite 15, Greenhill Enterprise Centre, University Drive, Mt Helen, Vic 3350 Australia
	Email Address	a.macleod@ballarat.edu.au
	Phone	+61 5327 9315
	Fax	n/a

Organization Name	**Polish Assotiation for Spatial Information**	
Business Contact	*Name*	**Jerzy Gaździski**
	Title	Professor
	Street Address	ul. Ledzka 15A, PL-01-446 Warsaw, Poland
	Email Address	gazdzicki@post.pl
	Phone	(+48) 22 8371287
	Fax	(+48) 22 8371287
Technical Contact	*Name*	**Janusz Michalak**
	Title	Research Scientist
	Street Address	Warsaw Uniwersity, Dept. of Geology, ul. Zwirki i Wigury 93, PL-02-089, Warsaw, Poland
	Email Address	J.Michalak@uw.edu.pl
	Phone	(+48) 22 55 40 529
	Fax	(+48) 22 55 40 501

Organization Name	**Polish Geological Institute - National Research Institute**	
Business Contact	*Name*	**Tomasz Nałęcz**
	Title	Senior specialist
	Street Address	76 Jagiellonska St., 03-301 Warsaw, Poland
	Email Address	Tomasz.Nalecz@pgi.gov.pl
	Phone	+48 22 45 03 601
	Fax	N/A
Technical Contact	*Name*	**Tomasz Nałęcz**
	Title	Senior specialist
	Street Address	76 Jagiellonska St., 03-301 Warsaw, Poland
	Email Address	Tomasz.Nalecz@pgi.gov.pl
	Phone	+48 22 45 03 601
	Fax	N/A

Organization Name	**Geological Surveys Germany**	
Business Contact	*Name*	**Bernhard Wagner**
	Title	Hydrogeology expert of INSPIRE-Network Geology of Geological Surveys in Germany
	Street Address	Bavarian Environment Agency – Geological Survey, Hans-Hoegn-Str. 12, 95030 Hof
	Email Address	bernhard.wagner@lfu.bayern.de
	Phone	+9281 - 1800 4740
	Fax	+9281 - 1800 304740
Technical Contact	*Name*	
	Title	
	Street Address	
	Email Address	
	Phone	
	Fax	

Organization Name	**British Geological Survey (BGS)**	
Business Contact	*Name*	**John Laxton**
	Title	Information Manager
	Street Address	Murchison House, West Mains Rd, Edinburgh, EH9 3LA, United Kingdom
	Email Address	jll@bgs.ac.uk
	Phone	+44 0131 667 1000
	Fax	+44 0131 668 2683
Technical Contact	*Name*	**Andrew Hughes**
	Title	Principal Hydrogeological Modeller
	Street Address	Environmental Science Centre, Nicker Hill, Keyworth, Nottingham, NG12 5GG, United Kingdom
	Email Address	aghug@bgs.ac.uk
	Phone	+44 (0)115 936 3464
	Fax	+44 (0)115 936 3200

Organization Name	**Bureau de Recherche Géologiques et Minières (BRGM)**	
Business Contact	*Name*	**LAGARDE Pierre**
	Title	Head of the division “Scientific Information & Digital Technology”
	Street Address	3 Avenue Guillemin 45060 Orleans, France
	Email Address	p.lagarde@brgm.fr
	Phone	+33 02 38 64 30 05
	Fax	+33 02 38 64 38 40
Technical Contact	*Name*	**GABILLARD Santiago**
	Title	IT specialist
	Street Address	3 Avenue Guillemin 45060 Orleans, France
	Email Address	s.gabillard@brgm.fr
	Phone	+33 02 38 64 37 92
	Fax	+33 02 38 64 38 40

Organization Name	**International Groundwater Resources Assessment Centre (IGRAC)**	
Business Contact	*Name*	**Neno Kukuric**
	Title	Director
	Street Address	Westvest 7, 2611 AX Delft, The Netherlands
	Email Address	neno.kukuric@un-igrac.org
	Phone	+31 15 215 1892
	Fax	N/A
Technical Contact	*Name*	**Lena Heinrich**
	Title	Researcher
	Street Address	Westvest 7, 2611 AX Delft, The Netherlands
	Email Address	lena.heinrich@un-igrac.org
	Phone	+31 15 21 51 806
	Fax	N/A

Organization Name	**Salzburg University: Z_GIS – Department of Geoinformatics (Z_GIS)**	
Business Contact	*Name*	**Hermann Klug**
	Title	
	Street Address	Schillerstrasse 30, Building 15, 3rd. Floor
	Email Address	hermann.klug@sbg.ac.at
	Phone	+43 (0)662 8044 7561
	Fax	+43 (0)662 8044 7560
Technical Contact	*Name*	**Alexander Kmoch**
	Title	PhD Student
	Street Address	Schillerstrasse 30, Building 15, 3rd. Floor
	Email Address	alexander.kmoch@live.unigis.net
	Phone	+64 (0) 21993574
	Fax	+43 (0)662 8044 7560

Organization Name	**Office International de l'Eau (OIEau)**	
Business Contact	*Name*	**Dimitri MEUNIER**
	Title	Head of the normalization & information systems department
	Street Address	15 rue Edouard Chamberland 87065 LIMOGES Cedex, France
	Email Address	d.meunier@oieau.fr
	Phone	+33 5 55 11 47 93
	Fax	+33 5 55 11 47 48
Technical Contact	*Name*	**Sylvain GRELLET**
	Title	Data modeling / SDI Engineer
	Street Address	15 rue Edouard Chamberland 87065 LIMOGES Cedex, France
	Email Address	s.grellet@oieau.fr
	Phone	+33 5 55 11 47 95
	Fax	+33 5 55 11 47 48