



Open
Geospatial
Consortium

OGC standards for geotech

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4 April 2024



About OGC



- OpenGeospatial Consortium. <https://www.ogc.org/>
- Home of geospatial innovation, collaboration, and standards.
- An international membership organisation that supports a diverse community of 500+ businesses, government agencies, research organizations, and universities, all working together to make location information **FAIR – Findable, Accessible, Interoperable, and Reusable**.
- Data models and Application Programming Interfaces (APIs)
- APIs:
 - « Old »: WxS services (WMS, WFS,...)
 - « New »: API Features, SensorThingsAPI

OGC Standards and Working Groups for Geoscience

GeoSciML

The GeoScience Markup Language (GeoSciML) is a data model and data transfer standard for geological data.

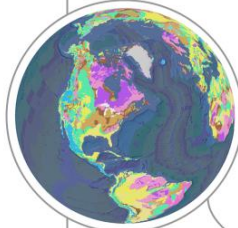
It formalizes the description of geological features commonly portrayed in geological maps, cross sections, geological reports and databases. It provides geological surveys, and other geoscience data providers, a common vocabulary for the electronic dissemination of geoscientific information.

GeoSciML is an XML-based data transfer standard for the exchange of digital geoscientific information. It accommodates the representation and description of features typically found on geological maps (eg. geologic units, structures, earth materials), as well as being extensible to other geoscience data such as drilling, sampling, and analytical data.

Supporting objects such as the geologic timescale and vocabularies are also provided as linked resources, so that they can be used as classifiers for the primary objects in the GeoSciML standard.

GeoSciML is used in the OneGeology project to propose a dynamic digital geological map data for the world.

Resources: <http://www.geosci.org/>
<https://www.openeospatial.org/standards/geosci>

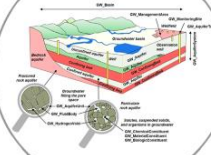


OGC
Making location count.
www.openeospatial.org

The Open Geospatial Consortium (OGC) is an international organization committed to develop and promote open standards for the global geospatial community. Its membership includes more than 500 organizations that come from across government, commercial organizations, non-governmental organizations, academic, and research institutes.

OGC activities address both semantic and technological standardization in a wide variety of domains including: Geosciences & Environment; Smart Cities, IoT & Sensor Webs, mobile technology, 3D & Built Environment, Emergency Response & Disaster Management, Energy & Utilities, and many more.

With the main objective to propose standards to the International Organization for Standardization (ISO), OGC regularly collaborates with other international organizations, such as Research Data Alliance, the World Meteorological Organization or buildingSMART International and many more in order to propose consistent standards and solutions.



GroundWaterML2

The GroundWater Markup Language 2 (GroundWaterML 2 or GWML2) is an international standard for the online exchange of groundwater data that addresses the problem of data heterogeneity.

This problem makes groundwater data hard to find and use because the data are diversely structured and fragmented into numerous data silos. Overcoming data heterogeneity requires a common data format; however, until the development of GWML2, an appropriate international standard has been lacking.

As part of the WaterML 2.0 standard and linked to GeoSciML, GWML2 introduces some concepts such as aquifers and water wells, as well as related measurements and groundwater flows.

It describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

GWML2 has developed, tested and implemented by several groundwater data providers from North America, Europe, and Australasia, and facilitates many forms of data exchange, information representation, and the development of online web portals and tools.

Resources: <https://www.openeospatial.org/standards/gwml2>



Even though several standards already exist to describe a borehole, its associated data and their position along a borehole (including OGC standards), they all restrict themselves to a specific viewpoint.

Involving key implementers and editors of the existing standards, the Borehole Interoperability Experiment (Borehole IE) aims at defining a domain agnostic and comprehensive (umbrella) vocabulary for a general concept of boreholes, which may eventually become its own specification and be properly reused by various domains when needed.

Based on a wide variety of use cases such as 'scientific exchange within and across research infrastructures', 'industrial', 'building and construction', 'regulatory obligations' and 'geosciences monitoring and exploitation' it will provide the basis for establishing a better integration of existing standards and possibly a future common approach for describing boreholes.

The Borehole IE is defining a domain neutral semantic for a general concept of borehole and its associated data. It will also produce a public OGC engineering report summarizing the overall cross-domain, inter-standard findings and recommendations for a best practice implementation that should follow.

Resources: <https://github.com/openeospatial/boreholeie/>
<http://www.openeospatial.org/projects/initiatives/boreholeie>

BoreholeIE

Volcanology
Mineral resources
Seismology
Geology
Mining
HydroGeology
Soil
Oil & gas
Geophysics
Underground constructions

The GeoScienceDWG is a joint group between OGC and the Commission for the Management and Application of Geoscience Information of the International Union of Geological Sciences (CGI-IUGS).

The GeoScience Domain Working Group (DWG) is a forum to discuss, organize and harmonize geoscience related standards.

In this context, Geoscience encompasses several scientific domains which all aim to provide a better understanding and representation of the Earth: Geology, Geomechanics, Geophysics, Geotechnics, Hydrogeology, Mineralogy, Seismology or Volcanology.

Goals of GeoScienceDWG include: 1- Foster technical solutions which support interoperable concepts, data definitions, formats and services for publishing, search, and exchange of geoscience information; 2- Ensure thematic/semantic coherence within the Geoscience domains and the Geoscience related ones; and 3- Establish a workable approach to managing standards for geoscience spatial features, their temporal aspects, related metadata, and other business information.

First actions of the group focus on the realization of three Interoperability Experiments: 1 - Linked Data for Environmental Features, 2 - Borehole and associated data information description, and 3 - 3D-4D model discovery capabilities.

Resources: https://external.openeospatial.org/twiki_public/GeoScienceDWG/WebHome

GeoScienceDWG



The Environmental Linked Features Interoperability Experiment (ELFIE) is intended to test existing OGC and W3C standards with the goal of establishing a best practice for exposing links between and among environmental domain and sampling features in a highly adoptable standards compliant way that is compatible with modern web search technology.

The IE is focused on two cross-domain use cases:

- 1) exposing topological and domain feature model relationships between features and
- 2) description of sampling data available for and linked to sampled domain features

While addressing these use cases, the IE has aimed to address issues of encoding data as specific views of a linked data graph that would be passed between systems. These linked data graph views are expected to support architectures involving linked data catalogs and registries.

For example, data providers can use the linked data graph views as a way to advertise their monitoring or domain features to catalogs or other applications that want to crawl and index available data. Similarly, integrated catalogs that index and construct links between features can use the views as a linked data response to search queries.

The IE has produced numerous experimental demonstration JSON-LD instance files and a number of demonstration visualizations.

Resources: <https://openeospatial.github.io/ELFIE/>

ELFIE



Interest from OGC GeoscienceDWG for geotech

- From [Toll, 2009]:
 - *“GeoSciML [...] aims to represent geoscience information associated with geologic maps and observations, **as well as being extensible in the long-term to other geoscience data.**”*
- Objectives:
 - Semantic consistency in the geoscience community
 - Seamless transition between GIS and BIM
- Contribution:
 - GeoSciML and GroundWaterML2 as a basis for extension to address geotech
 - Connection to other data models, including in OGC
 - Capacity to provide data on the web thanks to OGC API

Geotech concepts description and mapping

eg. <https://github.com/opengeospatial/Geotech/wiki/MaterialSample>

What is a MaterialSample?

A MaterialSample is a physical, tangible Sample.

Realizations

Data model	Concept name	Definition
OGC OMS	MaterialSample	A MaterialSample is a physical, tangible Sample.
IFC	MaterialSample	Same as OGC OMS
AGS	SAMP	SAMP includes information for both the sample and the
DIGGS	Sample	A material sample, either solid, fluid, or gas that is obtained by a sampling activity, for the purpose of observation and/or testing. This is a specialization of AbstractSample, which serves as the head of a subtree of sample specialties.
DIGGS	TrialGroutBatch	A specialization of Sample that also contains properties of a batch of grout developed for testing to determine a grout

Properties

PropertyName	Definition
internalIdentifier	The value of this property is the identifier originally created by the authority for this feature, or that is used as the identifier in the authority's internal data management system. If the internal identifier does not meet the semantic requirements or if the internal identifier may be included in this property in order for the authority to "back" the identifier to an internal data management system. The internalIdentifier is populated to identify the authority that uses the internalIdentifier.
chainOfCustodyEvent	Contains information on the chain-of-custody for the sample
relatedSample	Another Sample the context Sample is related to
purpose	
status	A text string to provide information about the status of the object, such as "in control", "review or release status", etc. The values used are intended to be maintained by an organization.
role	Identifies a specific role or task performed that is associated with the organization that performed the role, and associated time frame.
classification	A definition of the class of sample collected or produced, such as "soil", "rock", "fluid", etc.)

FAQ

What about Specimen?

In geotechnics, a distinction may appear between the MaterialSample collected on the field and another MaterialSample made from it by sub-sampling. The first one is often called Sample, while the second(s) is/are often called Specimen(s).

Here in this conceptual model, the term MaterialSample is generic and can be used for both. Attributes can be used to explain the lineage between two (or more) MaterialSample.

Standards like DIGGS yet propose an explicit terminology.

What about Sampling?

The sampling activity can be described with <https://github.com/opengeospatial/Geotech/wiki/Sampling>

ISO & OGC standards extensions for geotech

General considerations

- [About the Borehole IE and Sampling Boreholes](#)
- [Geometry considerations](#)
- [Features properties vs observations](#)

ISO19148 and ISO19156

- [A brief introduction to ISO 19148 and ISO 19156](#)
- [Enabling linear referencing based observations](#)
- [Conceptual Borehole Model](#)

SensorThingsAPI datamodel

- [A brief introduction to the SensorThingsAPI data model](#)
- [STA Borehole Model](#)

GeoSciML

- [A brief introduction to GeoSciML](#)
- [Extending gsml:GeologicUnit](#)
- [Extending gsml:ShearStructureDisplacement](#)
- [Extending gsml:Fold](#)
- [Extending gsml:Contact](#)
- [Adding gsml:GeotechUnit](#)
- [Extending gsml:Joint](#)

GroundWaterML2

- [A brief introduction to GroundWaterML2](#)
- [Extending gwml2:HydroGeoUnit](#)
- [Extending gwml2:FluidBody](#)
- [Extending gwml2:FluidBodySurface](#)
- [Extending gwml2:HydroGeoVoid](#)

EPOS WP15

- [A brief introduction to the EPOS TCS GIM](#)
- [Extending eposl:Modelview](#)

LandInfra & InfraGML

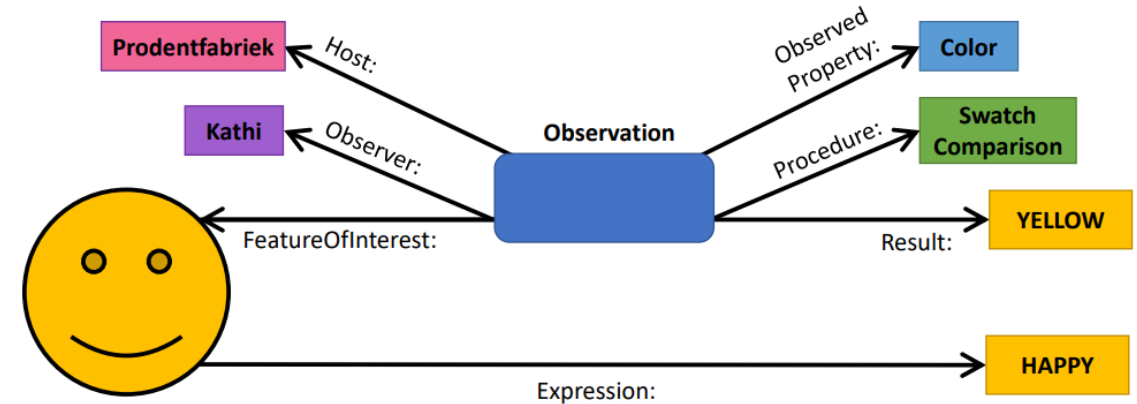
- [A brief introduction to LandInfra and InfraGML](#)
- [Reusing InfraGML:Alignment](#)
- [Extending InfraGML:Facility and FacilityPart](#)

INSPIRE Theme III: Natural Risk Zone

- [A brief introduction to INSPIRE NZ](#)
- [Extending NZ:HazardArea](#)
- [Extending NZ:RiskZone](#)

ISO 19156: Observations, Measurements and Samples (OMS)

- An OGC standard that came to ISO
- Providing observation results **and all its context**
 - What? (ObservedProperty, FeatureOfInterest)
 - When and where? (Time, Location)
 - Who and how? (Observer, Procedure)
 - Now including sampling and preparation
- Providing links between the observations
 - Provenance
- A standard to facilitate the reuse of observations

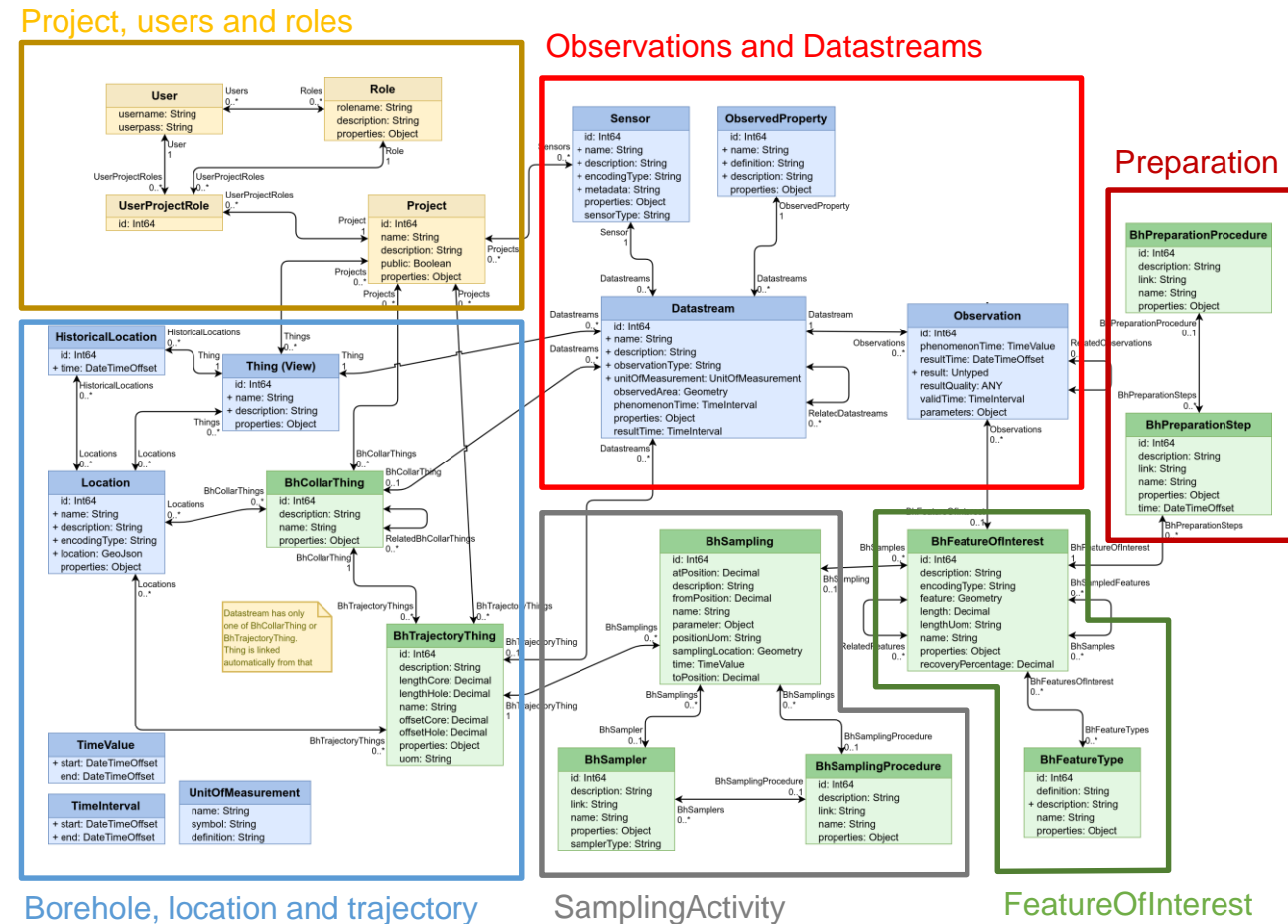


Credits: Kathi Schleidt, DataCove.

<https://www.youtube.com/watch?v=bYDSgs2fKLk>

OGC SensorThingsAPI for Geotech

- An OGC API to provide data according to OMS
- Originally from IoT
- Extended in GeotechIE to address borehole (linear referenced) data
- Tested with AGS and DIGGS data to provide GeologyLogs, CPT, SPT, Pressuremeter, AtterbergLimits.
- Guidance, demo and plugin :



<https://github.com/opengeospatial/Geotech/wiki/FROST-Plugin-for-Geotech>

OGC standards for Geotech

- Geotech concepts commonly defined with bSI IFC Tunnel GeoSubgroup, AGS and DIGGS
- Multiple proposal of OGC standards extensions to target consistency in the geoscience domain
- Experimentations of OGC API (SensorThingsAPI) to provide geotech data
- Main use cases:
 - Access geotech investigations from a BIM environment thanks to OGC API
 - Be able to provide AGS and DIGGS data thanks to OGC API
 - Describe geotech objects in GIS and access them from a BIM environment

Thanks for your attention!

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- Questions?