# **2018 03 23 - Orléans TC ad’hoc meeting**

## Attendees

* Eric Boisvert (GSC)
* Marcus Sen (BGS)
* Rob Atkinson (OGC)
* Mickaël Beaufils (BRGM)
* Alistair Ritchie (Manaaki Whenua – Landcare Research)
* James Passmore (BGS)
* Christelle Loiselet (BRGM)
* Abdel Feliachi (BRGM)
* Sylvain Grellet (BRGM)
* Boyan Brodaric (GSC)
* Benjamin Pross (52°North)
* Katharina Schleidt (Data Cove)
* Chuck Heazel (WiSC Enterprises)
* Remote : Steve Richard (AZGS)

## Use Cases

- logical model -> transport schema

- conceptual model -> more appropriate for the ontology

- taxonomy could be inferred from both

Eric

# 2 main use cases :

- support NR-Can LOD initiative: need types, link to some of those schemas (rdfs)

- JSON-LD, encoding for GeoSciML, GWML2

Boyan

* Same as Eric
* + Annotate other serialization -> logical model
* Reasoning

Marcus

* Needs for a general BestPractice

Rob

* OGC NA needs to zero in on canonical approach to publish ontologies within knowledge base - including Linked Data discovery visualisation and navigation and access to normative documents.
  + 19109 owl model (what does community recommend/need here?)
  + Base URI patterns (under [www.opengis.net/def](http://www.opengis.net/def)/)
  + URI patterns for appschema, feature types, properties, codelists
  + Entailing inherited properties of feature types in LD layer
  + Relationship of logical and conceptual model
  + Need to publish mappings to other external models as examples? Community implementation resources ?
  + Publishing profiles of standards
* Supporting ELFIE - publishing HY\_Features
* Supporting anyone else in future -> BP, Guidance white paper output
* Canonical ontologies
  + SOSA for O&M (??)

Alistair

* JSON-LD data publication

James

* same as Marcus
* + OneGeology needs
* Polyhierarchical codelists+

Sylvain

* LinkedData needs : JSON-LD data publication need to be able to point to reference ontologies for our domain objects
* Semantic web needs : internal project at BRGM to create a knowledge base.

Enrich it from reports content (Automatic Language Treatment) and reason over it

## Other potential resource document

* Draft RDF encoding rules for INSPIRE developed in the ARE3NA ISA action [http://inspire-eu-rdf.github.io/inspire-rdf-guidelines/](https://emea01.safelinks.protection.outlook.com/?url=http%3A%2F%2Finspire-eu-rdf.github.io%2Finspire-rdf-guidelines%2F&data=02%7C01%7CS.Grellet%40brgm.fr%7Ca2d6f3b6427642a2e7b308d590989c50%7C9610f79254fa49639560a8a822cba6d7%7C1%7C0%7C636573907497588021&sdata=WPFgrSgWA4wOLSKf0%2FX0tq1wwUvuzfPBZSRdznDc3FY%3D&reserved=0)
* SSN extension: [https://w3c.github.io/sdw/proposals/ssn-extensions/](https://emea01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fw3c.github.io%2Fsdw%2Fproposals%2Fssn-extensions%2F&data=02%7C01%7CS.Grellet%40brgm.fr%7Cdc3fccf186bc4fd97fd408d58a62739c%7C9610f79254fa49639560a8a822cba6d7%7C1%7C1%7C636567077832905403&sdata=PMQrjhv%2Fir4XZS4nOzyYxZBRb7%2BTn7Ex3cAVC96LE3I%3D&reserved=0)

# **Strategies for Publishing Domain Ontologies as Linked Data**

live edits from the document on GeoSciML GitHub : <https://github.com/opengeospatial/GeoSciML/blob/master/documents/Strategies%20for%20Publishing%20Domain%20Ontologies%20as%20Linked%20Data.docx>

## **Introduction**

ELFIE has explored publishing environmental observations as linked data, with data interpretation supported by having unambiguous references to key concepts in the data represented by additional links (URIs). Such concepts cover the nature of the properties of a data object, but also the key Use Case of linking an observation to the Feature of Interest.

## **Problem statement**

Common semantics for such properties and the type of the Feature of Interest, are identified by using published models – such as HY\_Features, GWML. These models (currently) are available in a normative forms as UML diagrams, an in some cases as XML schema, neither of which is conducive to dereferencing a URI for a concept to get more detail about that specific concept, or even to confidently match the identity of any references to concepts.

The requirement therefore is to be able to publish such models, as stable URIS, dereferencing as fine-grained Linked Data views. This means that a predictable URI naming scheme for elements in a model is required. (this may not be strictly necessary for a single model, but when a body of such models are managed by a single authority – such as OGC and its delegated Specification Working Groups – then commonality is necessary to avoid revisiting the naming strategy for each case, and to allow users to become familiar and comfortable with a consistent product.)

Within ELFIE context the need has been identified for at least two models, HY\_Features and GWML, and their multiple component Application Schema. The GeoSciML community is also looking at the same issues. There is a need for both efficiency and consistency to harmonise and document a common approach.

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ISO 19150-2 defines a set of rules for encoding UML as an OWL ontology referencing the suite of OWL artefacts created to model the ISO Harmonised Model.

This form of OWL has an unknown utility – by tying data types and concepts into the extensive ISO model this adds a high burden on clients to reason over the entire model (quite a large set of content) in order to identify fairly simple, but highly important, semantic baseline information – such as that a property may be treated as a xsd:integer for purposes of a calculation.) The feasibility of such reasoning is unknown, as there is no way to test the ISO models behave as expected under reasoning conditions.

Furthermore, for the purposes of Linked Data, much of the modelling of behavior of low-level data types is not relevant, when the main requirement is to identify concepts, access explanations, or potentially access information about implementations of these concepts that may be available.

Finally, from the perspective of infrastructure support, OGC provides a “definitions server” that is designed around SKOS meta-model and will provide dereferencing services and Linked Data representations.

## **Background**

BRGM have performed an initial analysis of the issues and questions that arise in the context of:

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· Generating ontologies for a subset of GeoSciML: GeoSciML Basic, Borehole and Lite,

· Testing populating instances for Boreholes, Geologic Units pointing to vocabs when available (FR, EU, CGI GTWG) and testing some representations (maps, graph).

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(<https://github.com/BRGM/GeoSciMLontology/blob/master/documents/ISO191xx_2_OWL_NoteBRGM.docx>)

These are relevant to the equivalent challenges for ELFIE, and collaboration with the GeoSciML, GWML and ELFIE activities has been initiated to develop a common solution.

The issues identified by BRGM have been further characterized from the perspective of definition publication process and governance. The following types of issues have been characterized:

1) weaknesses or issues with ISO 19150-2 rules

2) choices of options

3) non-canonical forms of additional constraints in UML and or OCL or tags

4) implementation choices for specific communities

5) meta-model issues (expressivity mismatches between OWL and UML)

6) bugs and limitations in software (or things too hard to configure)

7) best practices for documentation and annotation

The key meta-model issue I see here is the use of a character string (UML option) to hold an IRI in a particular implementation profile - and the trickiness of modelling this as an objectPRoperty or not. Option could be to model it as an rdfs:Property, and allow implementation profiles to constrain it to an owl:ObjectProperty.

## **Proposed strategy**

Resources, time and testing methodology for “hand building” optimal equivalent ontologies are not available (notwithstanding comments that these may lead to iterative refinement and improvement of the model).

The only automated pathway available to all participants currently is using Shapechange, which means developing a set of encoding rules from a wide range of choices and options from previous experiments in encoding different styles of UML model.

The ISO 19150-2 artefacts will be seen as an intermediate artefact (available by an annotation property reference from final product.)

“Manual interventions” to artefact to correct bugs or apply further rules will be encoded as RDF transformations or additional statements that can be applied in sequence.

If necessary, rules to extract basic OWL and xsd: datatype equivalence, without embedded reference to ISO datatypes will be developed and applied (Rob Atkinson as part of OGC-NA infrastructure)

Rules to extract SKOS equivalent glossary/taxonomy from OWL class models will be developed and applied (Rob Atkinson as part of OGC-NA infrastructure)

URIs under in [www.opengis.net/def](http://www.opengis.net/def) will be assigned, and content will be marked as draft, as an exercise in publication governance by OGC-NA, to make content and process available for wider discussion.

**Characterisation of issues**

(starting with BRGM notes)

### **Naming Policy**

OGC published ontologies will have URIs and Linked Data access based on identifiers under

Option 1: @prefix s1: http(s)://[www.opengis.net/def/](http://www.opengis.net/def/){ontology}/<authority>/<schema>/

ex:

Option 2: http(s)://[www.opengis.net/def/](http://www.opengis.net/def/)<authority>/<ont???>/<schema>/

ex:

Option 3: http(s)://[www.opengis.net/def](http://www.opengis.net/def/)/{ontology}/<schema>/

ex: [http://opengeospatial/def/schema/hyf](http://opengeospatial/def/ontology/hyf) -> owl model, rdf, xsd, json-ld context via content

[http://opengeospatial](http://opengeospatial/def/ontology/hyf)/def/schema/hyf/HY\_Waterbody -> will be the identifier of the class in the ontology

Option 4: http(s)://[www.opengis.net/def](http://www.opengis.net/def/)/<schema>/

ex: [http://opengeospatial](http://opengeospatial/def/ontology/hyf)/def/hyf ([http://opengeospatial](http://opengeospatial/def/ontology/hyf)/def/hyf/HY\_Waterbody)

[http://opengeospatial](http://opengeospatial/def/ontology/hyf)/def/gwml2

[http://opengeospatial](http://opengeospatial/def/ontology/hyf)/def/gsml

General semantic web BP

base/document/

base/id/

base/def/

<http://www.opengis.net/def/auth/> -> a bunch of different things

Class names will be UpperCamelCase names e.g. **s1:Class1**

Properties will be lowerCamelCase e.g. **s1:prop1**

(except for class scoped properties where names are ambiguous)

### **Weaknesses or issues with ISO 19150-2 rules**

- « The rules of ISO 19150-2 are restrictive on many aspects if we respect them all. Respecting all of them means we don’t take into account the open world assumption when working with ontologies”

- The transformation rules are consistent but limits the resulting ontologies to the UML paradigm. Some additional work may be done on the resulting ontologies to add semantics between classes (disjunctions, subsumption, equivalence, etc) and within or between properties (functional properties, transitive properties, symmetric properties, inverse of, etc).

- No specific indications about association classes are mentioned in the norm. It is obvious that an association class is translated as an OWL class. No rule for linking this class to the related class(es) appear

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### **Choices of options**

#### Property names in case of ambiguity within schema

·  *Properties naming when translating attributes: dots in properties identifiers could be interpreted somehow that they are still scoped to classes, while in ontologies, properties are scoped to a name space instead. Properties are independent entities that may or may not have a specific class as a domain. This is one major structural difference between UML and OWL. Allow scoped names for properties (class.Property) then verify whether automatically created properties can be merged into one (eg. GeologicFeature.purpose and EarthMaterial.purpose).*  *Use general (non-scoped to class) property names when the name of the attribute or association is unique. Thus, leave the domain of the properties open (or typed as owl:Thing). The restrictions on the properties values in the class definition can be used for this purpose.*

RESOLUTIONS:

1. Alignment documents as configurations are place to put subProperty relationships (role’ and role’’ are flavours of role ) - also equivalences across application schema
2. Skos:notation (datatype to be determined) to preserve original property name token - for display and reference to xpath elements

· Basic types (from SWE types for example) must be modified if needed by specialized Classes from other ontologies or by defining new ones

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· · Use GSML\_QuantityRange instead of swe:QuantityRange as recommended

· Rename swe:Category to skos:Concept or mdl:Lineage (depending on the case) and swe:Quantity to the relevant class in the context (ts:TimePosition, mdq:PositionalAccuracy, etc.)

· For the properties of GeoSciML Basic and Borehole to be reused in GeoSciML Lite, we activate the ShapeChange rule “rule-owl-prop-globalScopeByUniquePropertyName” that scopes unique name property to global use, and thus not specify the domain of these properties. The scoping of the properties to their classes in Basic and Borehole is done using restrictions on the values that these properties can take for their corresponding classes. This can be done thanks to the ShapeChange rule “rule-owl-prop-range-local-withUniversalQuantification”

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### **non-canonical forms of additional constraints in UML and or OCL or tags**

- The requirements of the model cannot be all respected in the ontology representation (eg. “QuantityRange properties that must report a single value SHALL assign both lower and upper value as equal to that single value.”). This should be checked and translated manually as restrictions (when possible) afterwards.

Implementation choices for specific communities

- ShapeChange “Map entries” provide a flexible way to choose recommended names for properties and classes. This would enable one to reuse existing specialized classes and properties from external ontologies.

- GeologicUnitView contains mixed information from Both GeologicUnit and MappedFeature. A decision must be made to which entity the view must be associated (using the same URI as the GeologicUnit or MappedFeature )

### **Meta-model issues (expressivity mismatches between OWL and UML)**

- The placeholder attribute “any” becomes useless property in owl à delete it.

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- Choice made to replace the “character string” data properties by object properties from GeoSciML Basic, borehole and other ontologies when possible (using the XPath mapping detailed in GeoSciML specification).

- <<type>> and <<FeatureType>> serialise to owl:Class - do we need to have further annotation or axiomitisation (<<datatype>>?)

- abstract class implications?

-> annotation about the class being abstract in UML. But in GSMLsome abstract classes were created to provide an extension point for GSML extension (ex: FoliationAbstractDescription); they provided a bag to list properties. Some might then be revisited/deleted (the only reason to keep them would be for schema mapping purposes but we considered it a low priority use case compared to to LinkedOpenData, Websem reasoning)

- union -> using owl:disjointUnionOf

- transitivity (ex: this property is the inverse of the other)

* Will support reasoning

=> should be added

### **Bugs and limitations in software (or things too hard to configure)**

- Association classes must be handled differently: ShapeChange transforms an association class into separate class and properties. Thus, no link is created between the association class and the classes that are initially related by it in the UML. No rule is found in ShapeChange to handle that.

This must be defined afterwards with two properties: associationSource and associationTarget (exactly as in passing from conceptual model to a logical schema). As a solution, this could be locally defined as [association name]+”Source” and [association name]+”Target”. These two properties must have the right domain and range. The direct property between the source and the target automatically created by Shapechange must be deleted.

### **Annotation practices**

- Version the ontology: use owl:priorVersion and owl:versionInfo properties to describe the ontology, and owl:deprecatedClass and owl:deprecatedProperty annotation properties to specify the version status of a class or a property when deprecated.

# **Outputs**

## **HY\_Features encoding example**

## **Summary of choices made**

## **Configuration references**

**Other 23 03 2018 decisions**

## Decision

### This document status

Considered mature enough as a starting point for further testings.

Rough draft of what might become a BestPractice / WhitePaper

### Ontology generation from OGC Standards

* 1°/ ShapeChange starting point : conceptual/logical model
* 2°/ manual adjustments according to what is written in that document

### Domain and range for properties

Get rid of domain and range for every property in the reference ontology to favour reuse. And specify it in application ontologies when reusing (if needed)

## Todos

1. Having HY\_Feature GitHub public : Rob
2. Refining the doc > GitHub : Abdel / Sylvain
3. Validate rdfMapEntries from ShapeChange

Abdel/Sylvain -> to the group for validation

1. Then, refine ontologies

GSML : basic, borehole, lite

GWML : HydroGeoUnit

HY\_Feature : core

1. Time line : touch base before fall

Around June : 2nd/3rd week

1. SWGs work

GeoSciML SWG work

1. OGC-NA infrastructure (Rob Atkinson)

Develop and apply rules to extract basic OWL and xsd: datatype equivalence, without embedded reference to ISO datatypes

Develop and apply rules to extract SKOS equivalent glossary/taxonomy from OWL class models

## Standing issues

### Usage of skos VS dedicated classes when <<codeList>> in the UML

The pattern proposed by ISO-19150-2 is to create a class for each property designed to hold a “term”. This class shall be a subtype of skos::Concept according to the spec. This is seen as a problem for some as SKOS is not the only possible way to encode vocabularies, as some might prefer to encode vocabularies as formal ontologies.

### Version URI

Do we need to specify where version numbers go in this URI scheme?

## ChangeRequest to 19150-2

### Union

Preferred using owl:disjointUnionOf