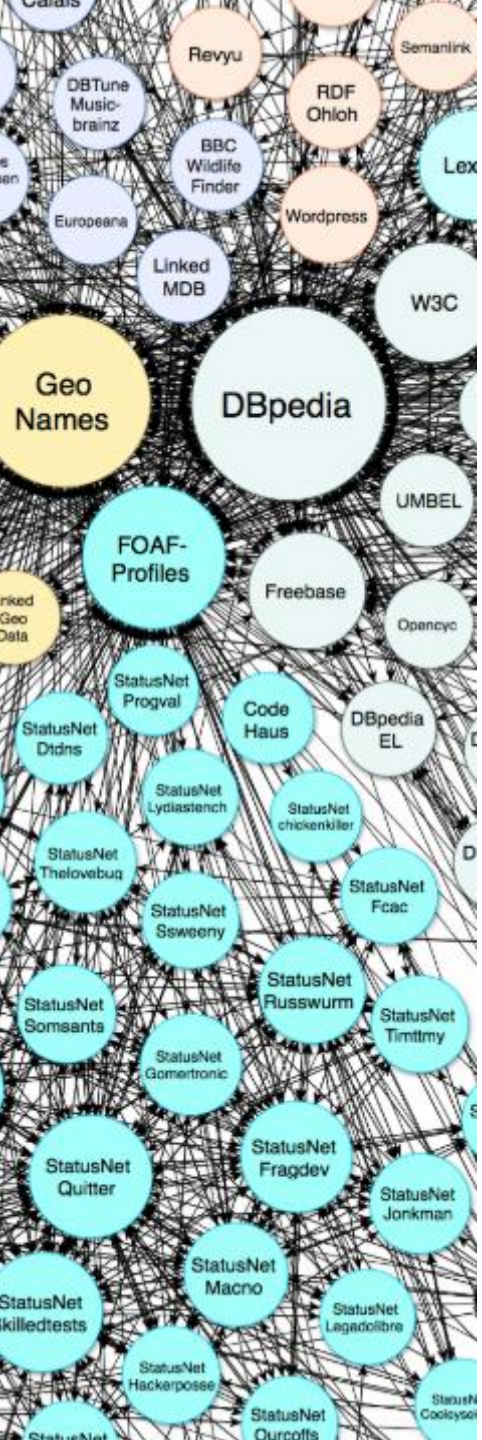
RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

Géosciences pour une Terre durable
brgm

THE INTEROPERABILITY TOOLBOX

Sylvain Grellet – BRGM
ENSG – mastère GDM – 2023-01-20

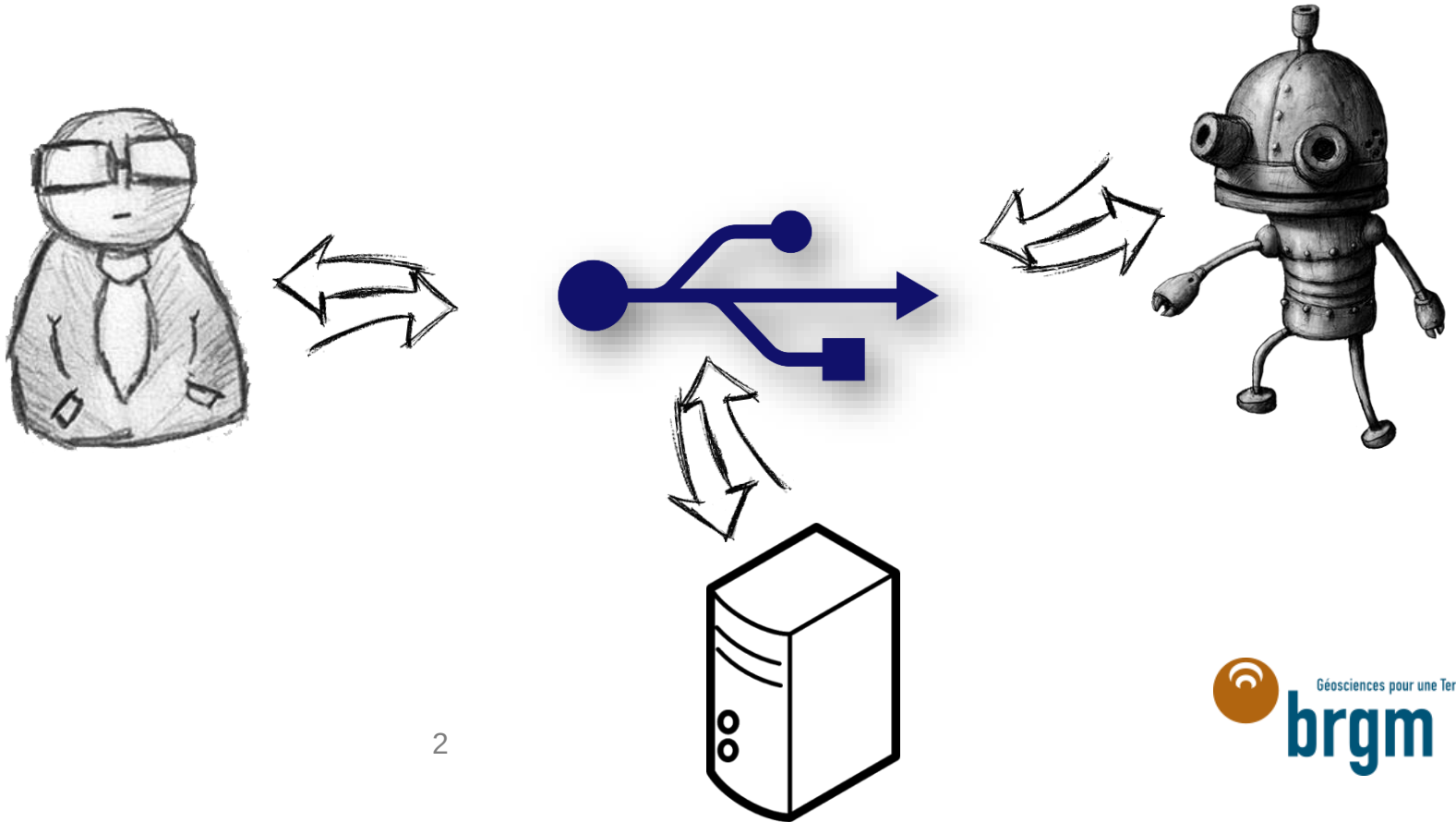


Interoperability

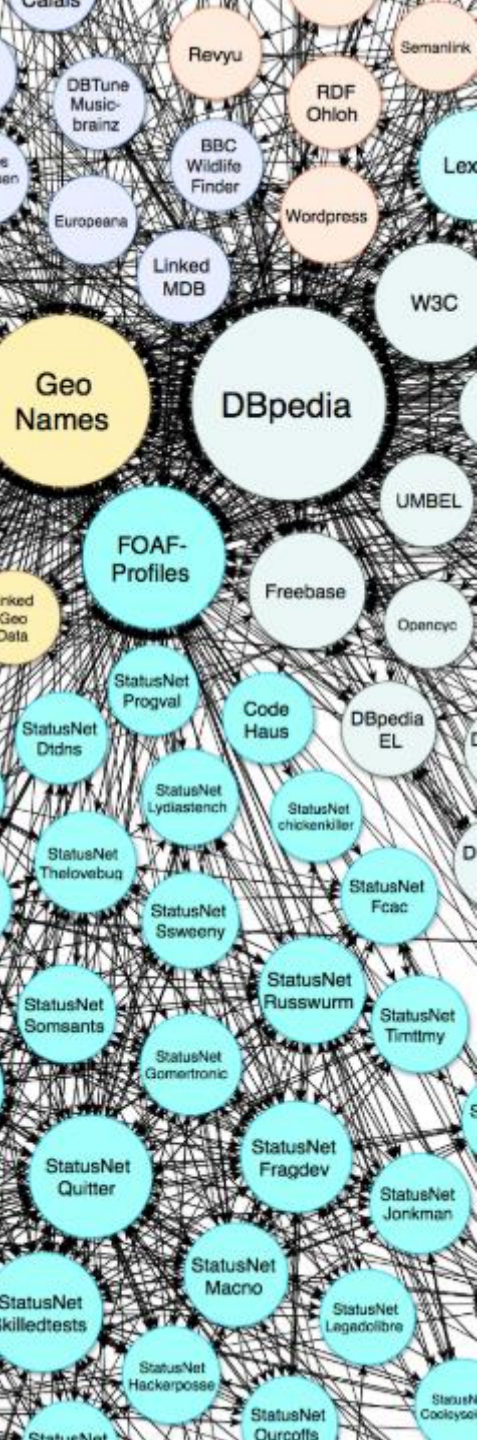
Draw me interoperability …

« The ability of a system or product to transfer meaning of information within and between systems or products without special effort on the part of the user » *Source : IEEE (Institute of Electrical and Electronics Engineers)*

« […] la capacité que possède un produit ou un système à fonctionner avec d'autres produits ou systèmes existants ou futurs […] » *Source : French government general interoperability framework*

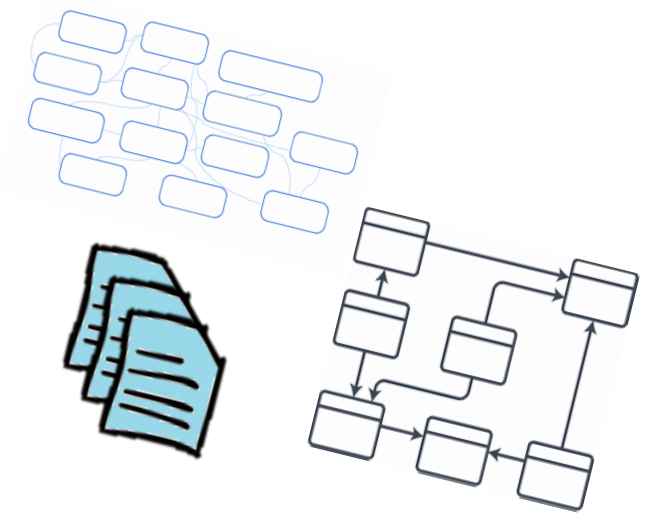


Géosciences pour une Terre durable
brgm



Interoperability

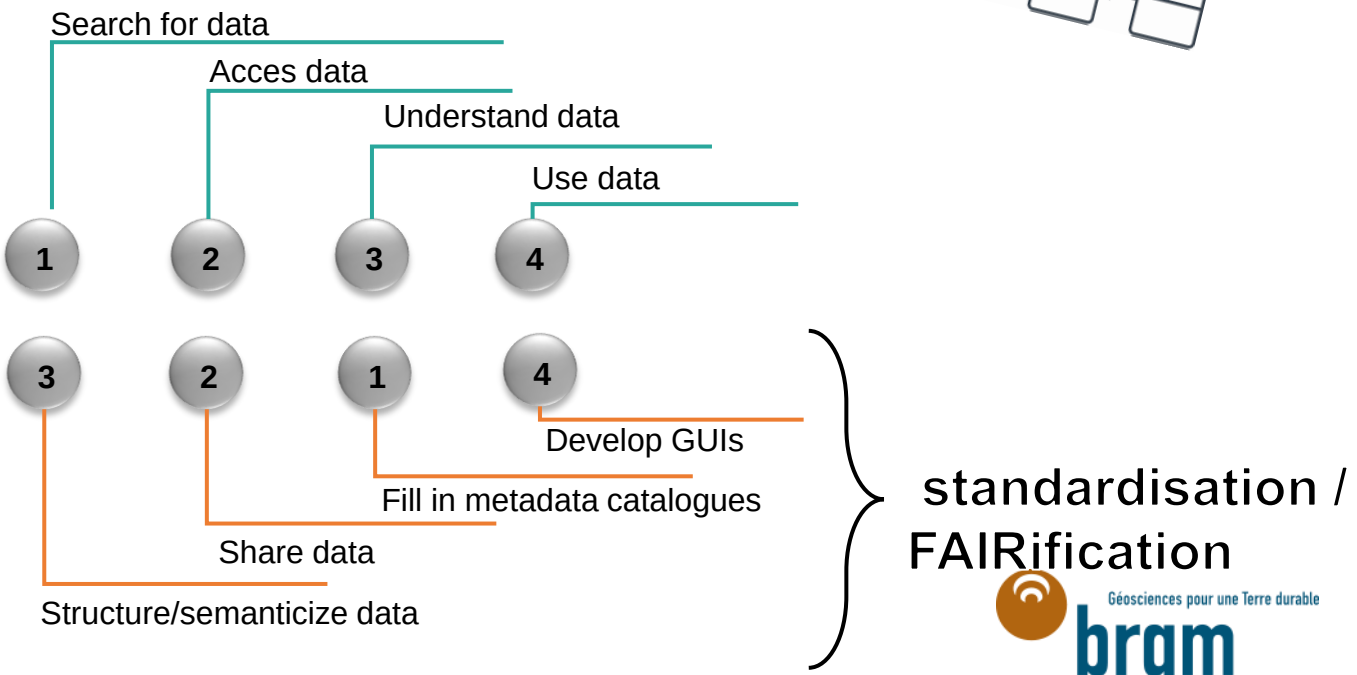
Challenges : numerous users, data heterogeneity, different needs



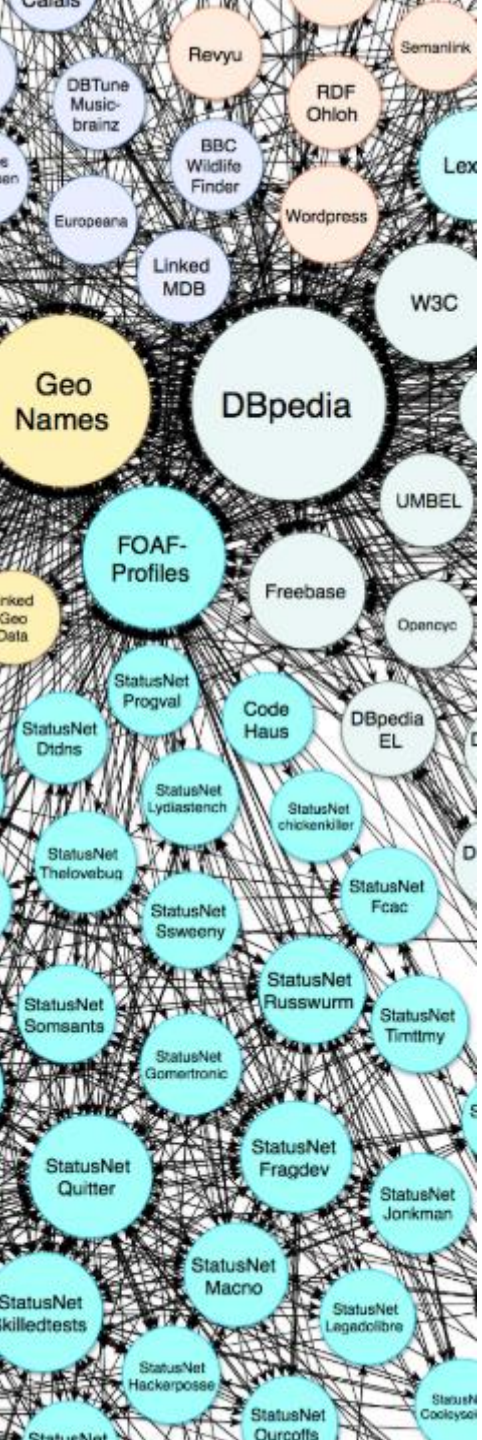
Domain expert

IT

A different priority order



Géosciences pour une Terre durable
brgm



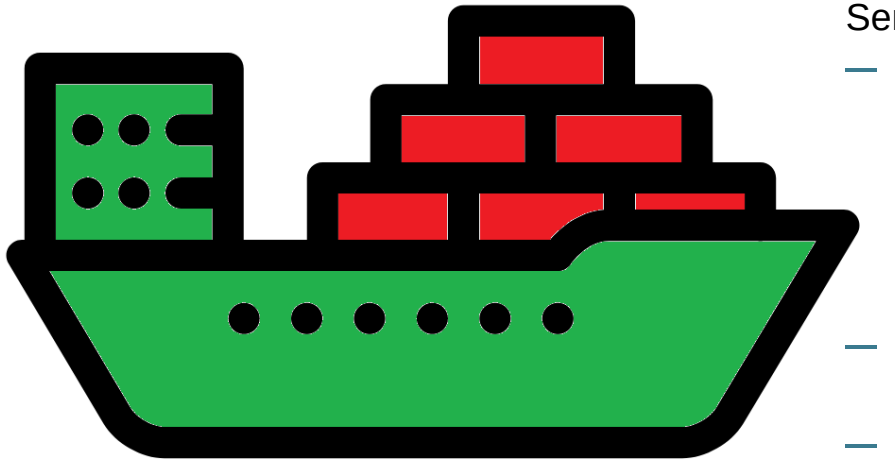
Interoperability

Towards more open standards

Standardisation of exchange methods

Technical interoperability

- Mainly OGC services/API building on IETF, W3C work
- (Spatial) data on the web Best Practices : W3C
- Community / national standards : but not always compliant to the above mentionned



Standardisation of content exchanged

Semantic interoperability

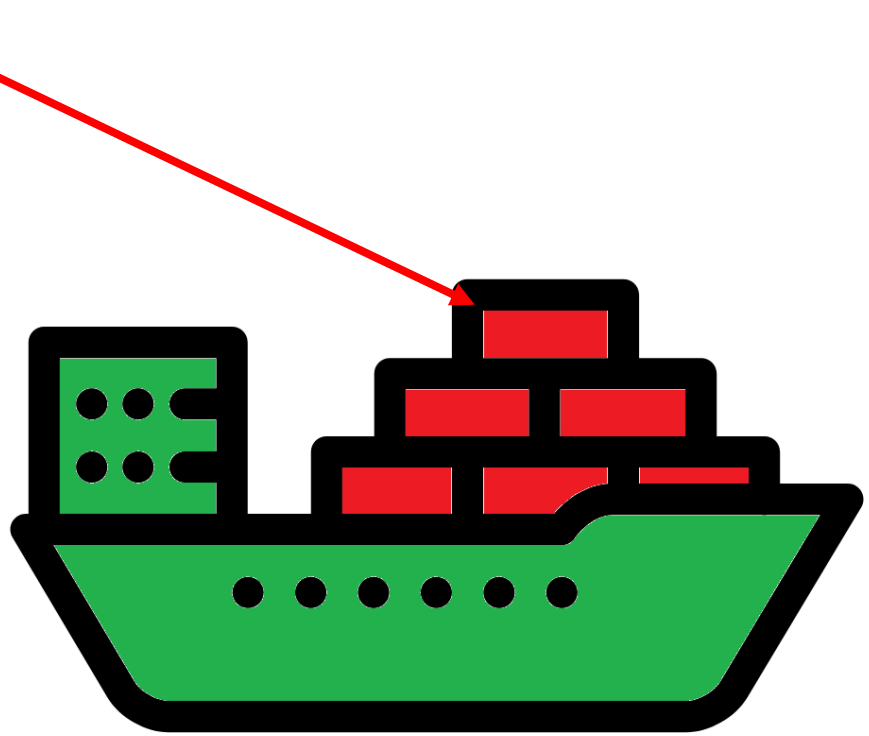
- International : ex. OGC (GeoSciML, EarthResourceML, HY_Features, GroundWaterML2.0, etc.), RDA, W3C
- (Spatial) data on the web Best Practices : W3C
- Continental: ex. INSPIRE
- National: ex. Geonovum
- Community : ex . ChEBI

Géosciences pour une Terre durable
brgm

Semantic interoperability

2 worlds we try to make work together

- UML
- Semantic Web approaches



Semantic interoperability

UML

- There are many OGC domain standards building around the ISO 191xx series of standards
  - City, Aviation, Land Infrastructure, Geosciences (Geology, Hydrology, HydroGeology, Mineral Resources, etc..), Observations, …
- There are standards
  - Having a legal value : INSPIRE, EU Environmental Directives reportings
  - Validated by communities
- One important way to discover them
  - is through the OGC portal
  - but there are other out there => the entire INSPIRE directive specifications are based on those
- They are implemented country (ex : Australia, France, USA, …) , continent (ex : INSPIRE), world (ex: International Union of Geological Science) and also organization wide (ex : World Meteorological Organisation)
- Trend to go to open standards describing domains

Semantic interoperability

UML

- Underlying logic
  - Model Driven Approach (MDA)

  Defining a domain model that is independent from the IT implementation

  => We use UML to clarify the semantics of a given domain part/need

  - 0°/ Use Cases definitions
    - Data exchange Use Case not GUI Use Case

  - 1°/ Defining the domain model
    - With domain expert (called maieutics)
    - IT Notation : UML with class diagrams (at least a Logical Model and sometimes Conceptual then Logical)
    - Using ISO 191xx series of standards and already existing standards as basic Lego bricks

Semantic interoperability

UML

- Underlying logic
  - Model Driven Approach (MDA)

  Defining a domain model that is independent from the IT implementation

  - 2°/ Going physical
    - Previous 20 years rationale : UML -> XSD (applying 19118 and 19136 rules)
    - Current target : JSON family (Geo-JSON, OGC Features and Geometries JSON) which requires a different set of rules
    - Current status : we are in an ‘in-between’ situation between maintaining compatibility with previous systems and applying new practices
  - 3°/ Exposing data with the interoperable semantics
    - Previous 20 years rationale : XML exposed by WebServices (WSDL, SOAP)
    - Current target : JSON served by REST FUL APIs
    - Current status : we are in an ‘in-between’ situation between maintaining compatibility with previous systems and applying new practices

Géosciences pour une Terre durable
brgm

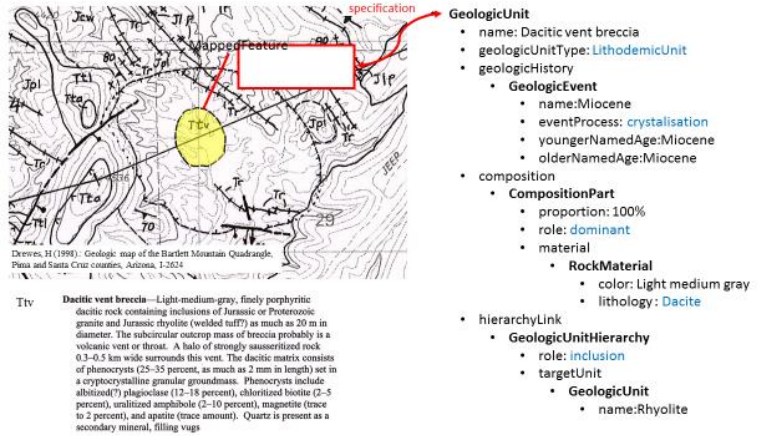
Semantic interoperability

UML

- Basic bricks are defined by ISO TC 211 => ISO 191xx series of standards (notion of Feature, time primitive, geometry primitive, Observations & Measurements, Metadata, Quality information etc…)
  - From https://github.com/ISO-TC211/HMMG/wiki
    - Read-Only access : http://iso.sparxcloud.com/index.php
    - Direct Enterprise Architect project download
    - Can be directly “imported” in a project through Enterprise Architect ‘Reusable Assets’

- Building on those bricks various domain standards are made
  - Lets quickly meet some of them

Semantic interoperability



NAME : GEOSCIML

Logical model of geological features commonly described and portrayed in geological maps, cross sections, geological reports and databases.

Age : V 4.1

Key features

- Covers the domain of geology (earth materials, geological units and stratigraphy, geological time, geological structures, geomorphology, geochemistry) and sampling features common to the practice of geoscience, such as boreholes and geological specimens.

Weight

- Full and ‘Lite’ versions

Children / Family

- Reused by many geological surveys and countries, continent wide spatial data/research infrastructures (INSPIRE, EPOS, AuScope, …)

Wishes

- Currently moving to the semantic web

Géosciences pour une Terre durable
brgm

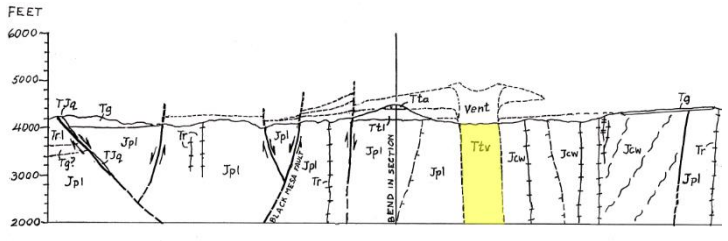
Semantic interoperability

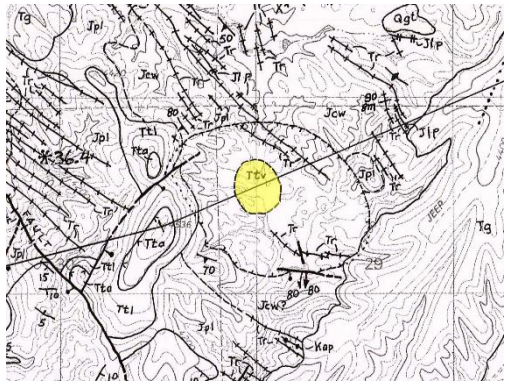
NAME : GEOSCIML

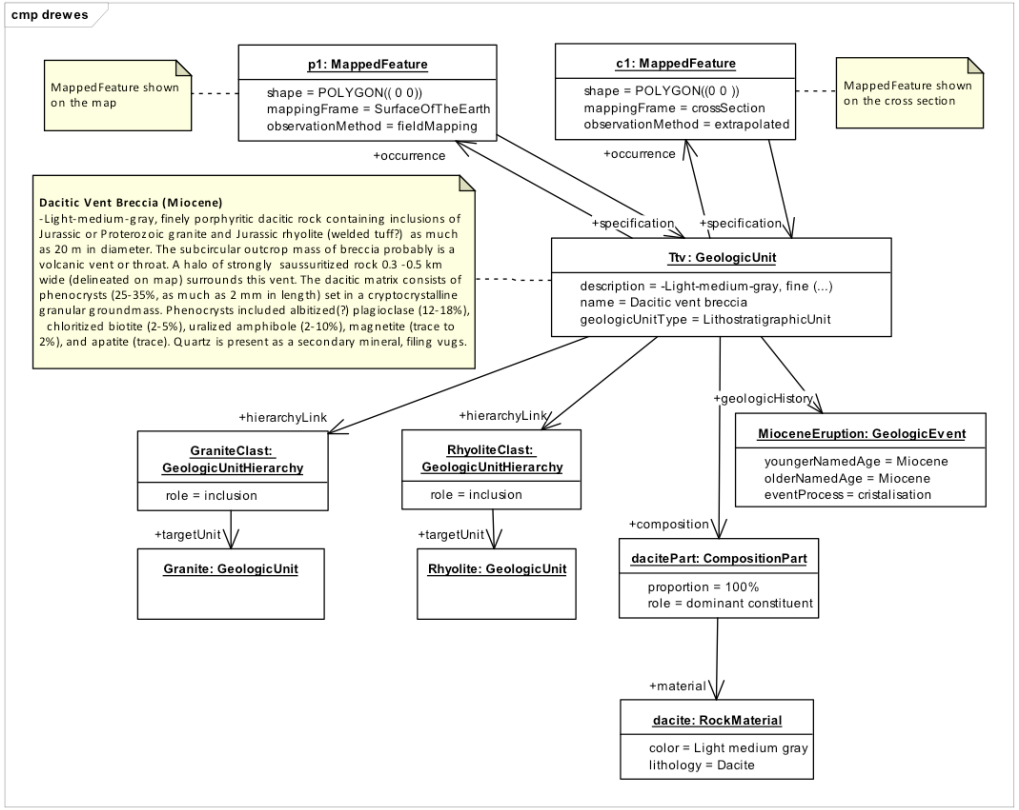
Contact

https://www.opengeospatial.org/standards/geosciml

Other pictures



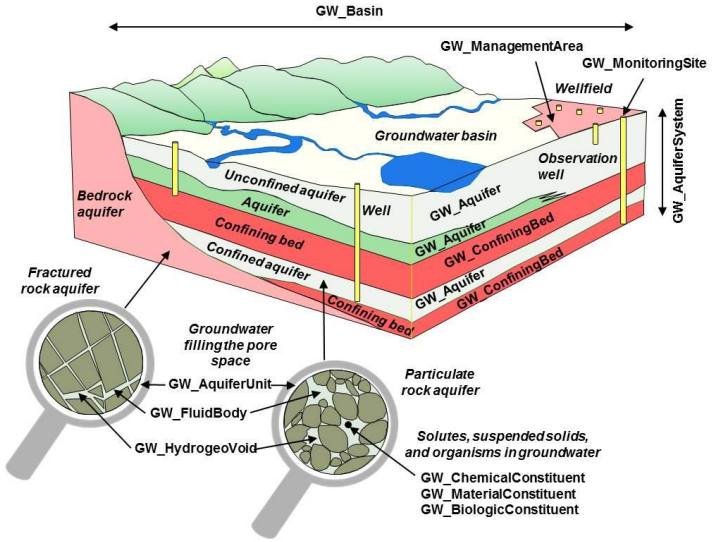




Semantic interoperability

NAME : GROUNDWATERML2

A conceptual and logical model for groundwater resources management



Age : V 2.2

Key features

- Core groundwater elements such as aquifers, their pores, and fluid bodies,
- Wells and construction component, springs, and monitoring sites
- Observations: constituents (bio, chemical, materials constituent), groundwater flow within/between containers,
- AquiferTest / pump test

Weight

- Full and draft ‘Lite’ versions

Children / Family

- Reused by many geological surveys

Wishes

- Currently moving to the semantic web

Géosciences pour une Terre durable
brgm

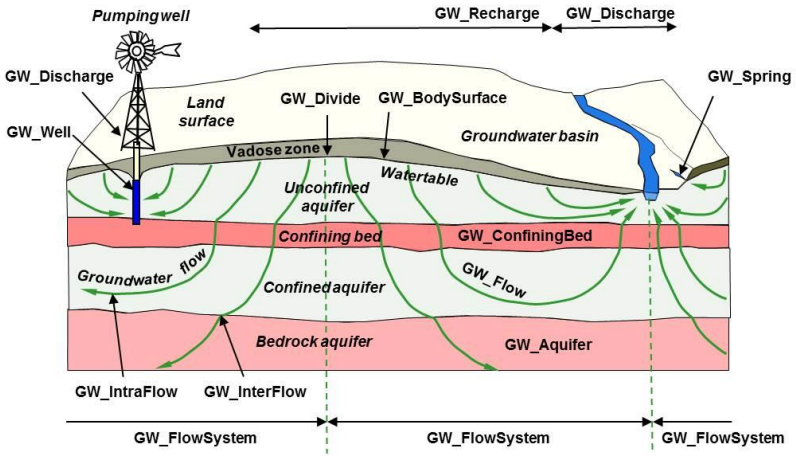
Semantic interoperability

NAME : GROUNDWATERML2

Contact

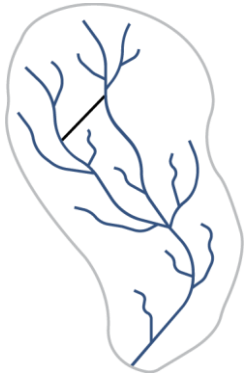
https://www.opengeospatial.org/standards/gwml2

Other pictures



Géosciences pour une Terre durable
brgm

Semantic interoperability



NAME : SURFACE HYDROLOGY FEATURES (HY_FEATURES)

A conceptual model describing hydrology features and their relationships independent of their geometric representation and scale.

Age : V 1.0

Key features

- Hydrology specific feature types, e.g. catchments, drainage networks, rivers, lakes and waterbodies, hydrometric features
- Focus is on surface water features and the networks they form.

Weight

- Full version

Children / Family

- USGS, NrCAN, BRGM, AU Hydrological Geo Fabric

Wishes

- Has moved to the semantic web

Géosciences pour une Terre durable
brgm

Semantic interoperability

NAME : SURFACE HYDROLOGY FEATURES (HY_FEATURES)

Contact

http://docs.opengeospatial.org/is/14-111r6/14-111r6.html

http://opengeospatial.github.io/HY_Features/HY_Features_primer/HY_Features_Primer.html#/

Other pictures

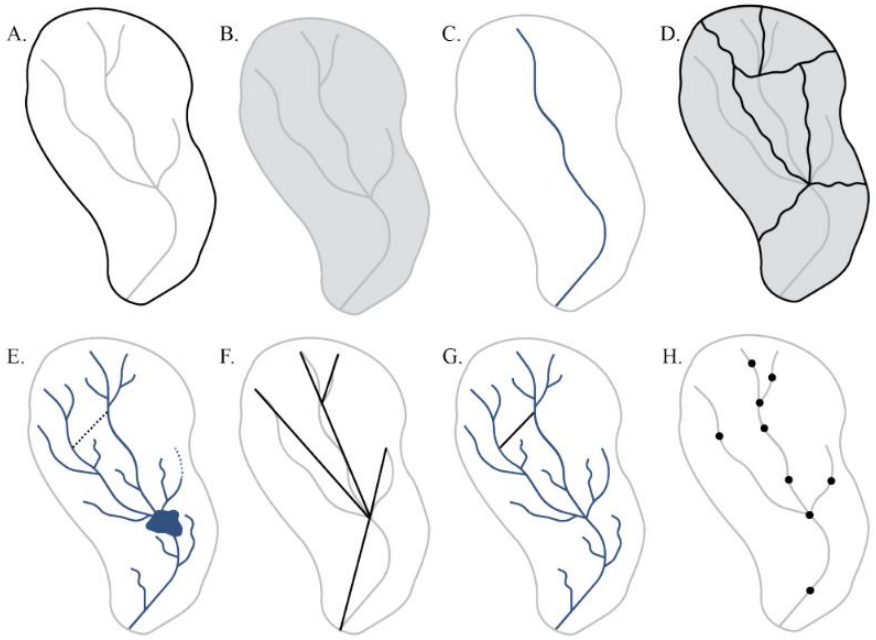
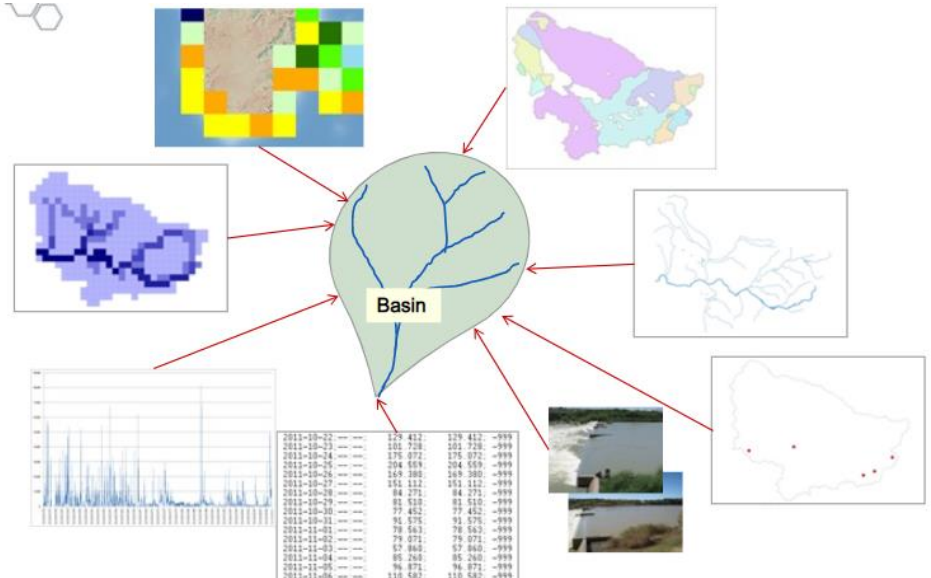


Figure 5. Multiple catchment realizations (top left to bottom right): a) catchment boundary, b) catchment area, c) catchment flowpath d) subcatchment network, e) hydrographic network, f) geo-schematic network, g) flow network, h) hydrometric network of monitoring stations.

Global Runoff Data Centre (GRDC)



Semantic interoperability

NAME : EARTHRESOURCEML

Logical model for the exchange of digital information for mineral occurrences, mines and mining activity.

Age : V 2.0

Key features

- Geological features of mineral occurrences, their commodities, mineral resources and reserves
- Mines and mining activities, and the production of concentrates, refined products, and waste materials.

Weight

- Full and ‘Lite’ versions

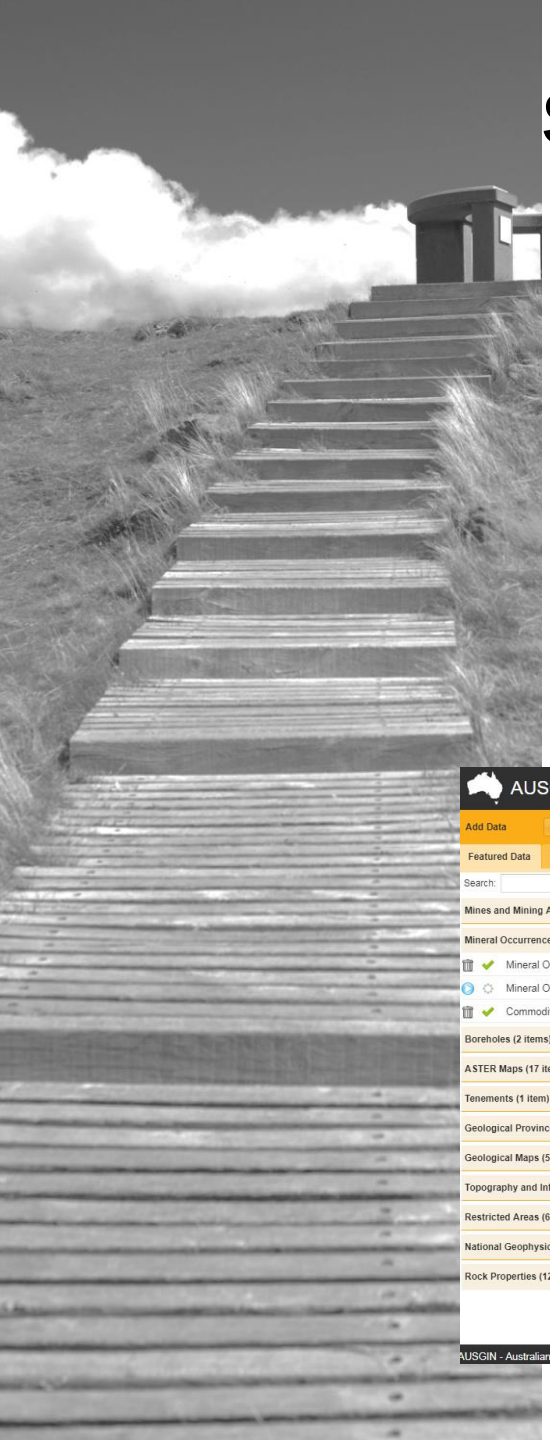
Children / Family

- Reused by many geological surveys and countries, continent wide spatial data/research projects (INSPIRE, Minerals4EU, EPOS, AuScope, …)

Wishes

- Currently moving to the waste (urban mine, secondary raw materials)

Géosciences pour une Terre durable
brgm



Semantic interoperability

NAME : EARTHRESOURCEML

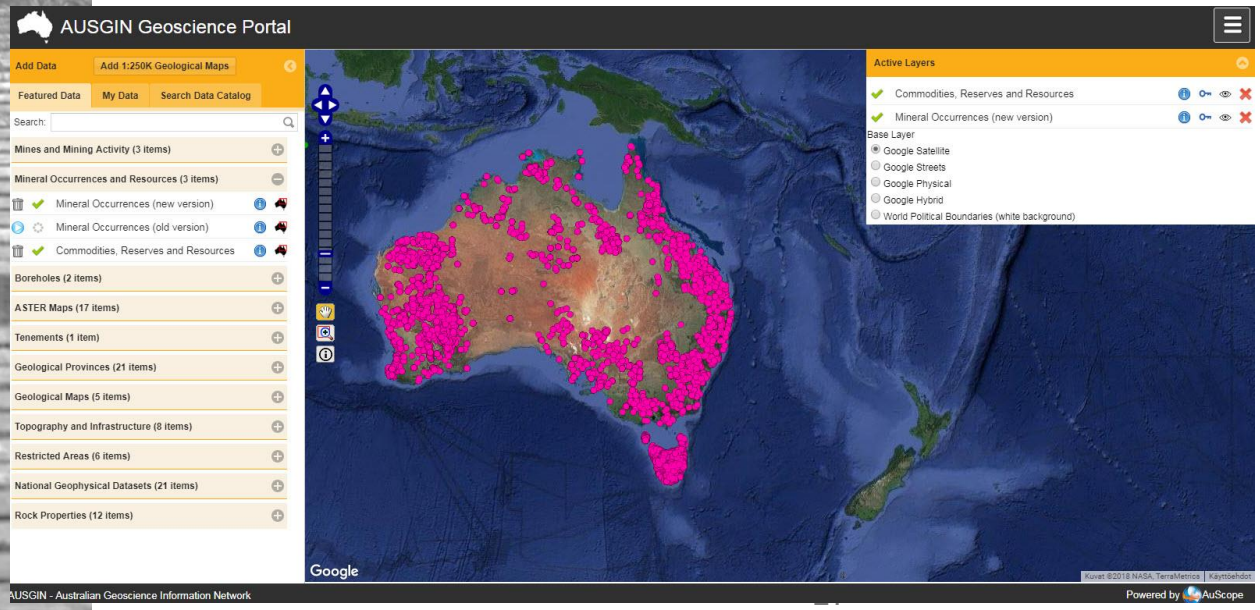
Contact

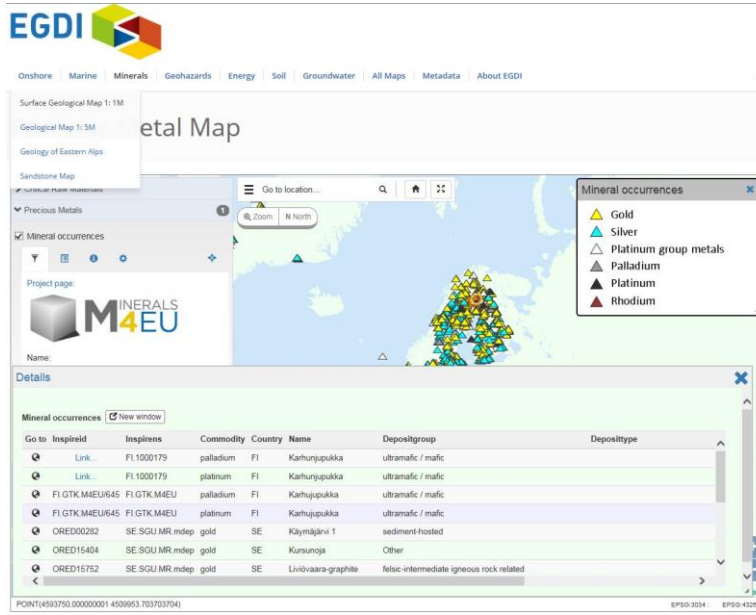
http://www.earthresourceml.org/

Comments

Is not OGC but IUGS/CGI (where GeoSciML incubated), is connected to GeoSciML and driven by the ‘same’ experts.

Other pictures

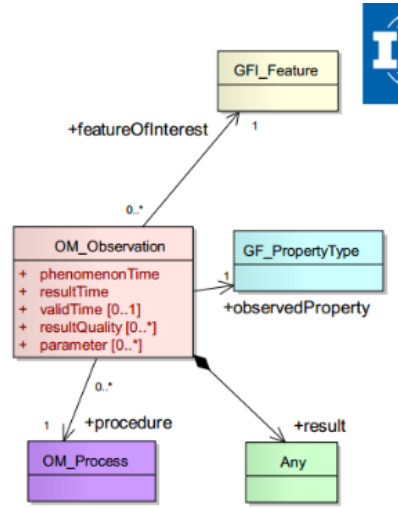




Semantic interoperability

NAME : OBSERVATIONS, MEASUREMENTS & SAMPLES

Conceptual and logical model for observations and features involved in sampling when making observations for the exchange of information within and between different scientific and technical communities.



Age : V 2.0 (revision just finishing)

Key features

- Description of the observation acts and their results
- A common set of sampling feature types classified primarily by topological dimension, as well as samples for ex-situ observations.
- Relationships between sampling features (subsampling, derived samples)

Weight

- Full and ‘Lite’ versions

Children / Family

- Many international reuse by communities, profiles

Géosciences pour une Terre durable
brgm

Semantic interoperability

NAME : OBSERVATIONS, MEASUREMENTS & SAMPLES

Wishes

- Just arrived in the semantic web -> W3C: SOSA/SSN

Contact

https://www.opengeospatial.org/standards/om

Comments

- Previous domain standards **all refer to / build on Observations and Measurements** (ISO 19156:2011)
- International ISO Standard (ISO 19156:2011 “Observations & Measurements” -> now updated into 19156:2022 “Observations, Measurements & Samples”)
- Major uptake in
  - Domains (see next slide)
  - Also standardization bodies (ex : W3C SSN/SOSA)

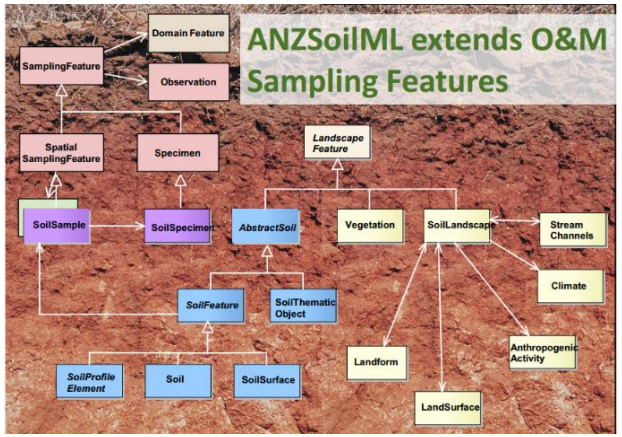
Géosciences pour une Terre durable
brgm

Semantic interoperability

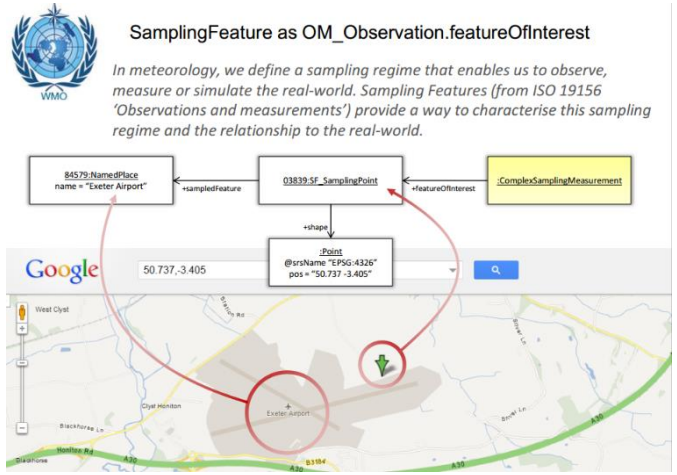
NAME : OBSERVATIONS, MEASUREMENTS & SAMPLES

Other pictures

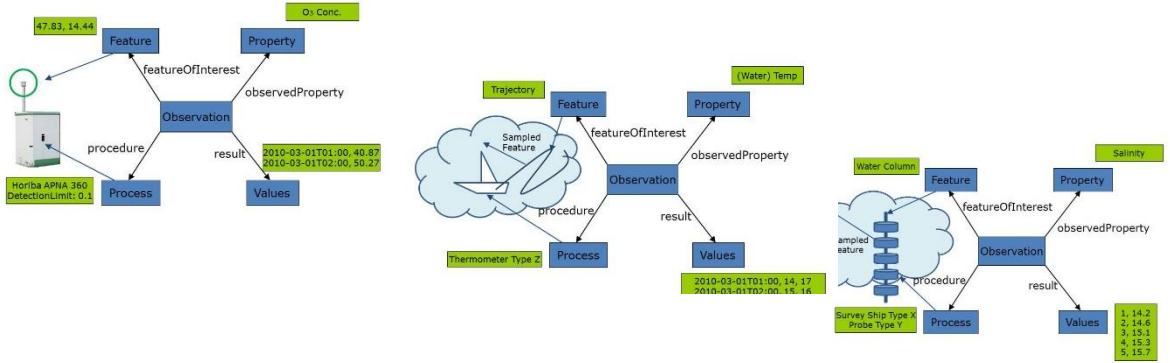
(note all based on the 2011 version)



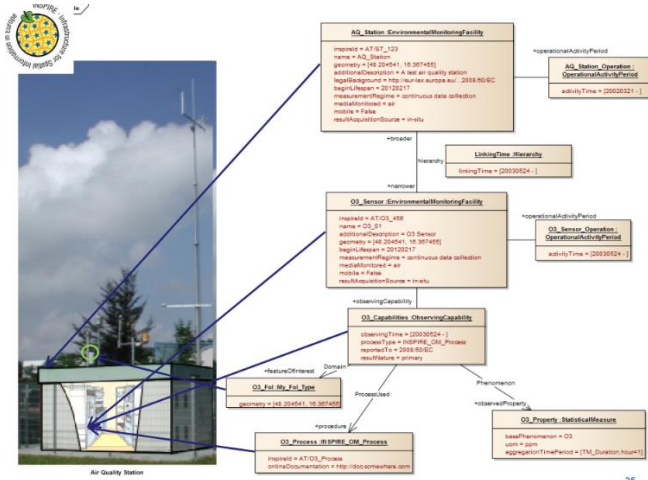
WMO ‘METeorological Community Exchange’ model



EU INSPIRE guidelines for O&M



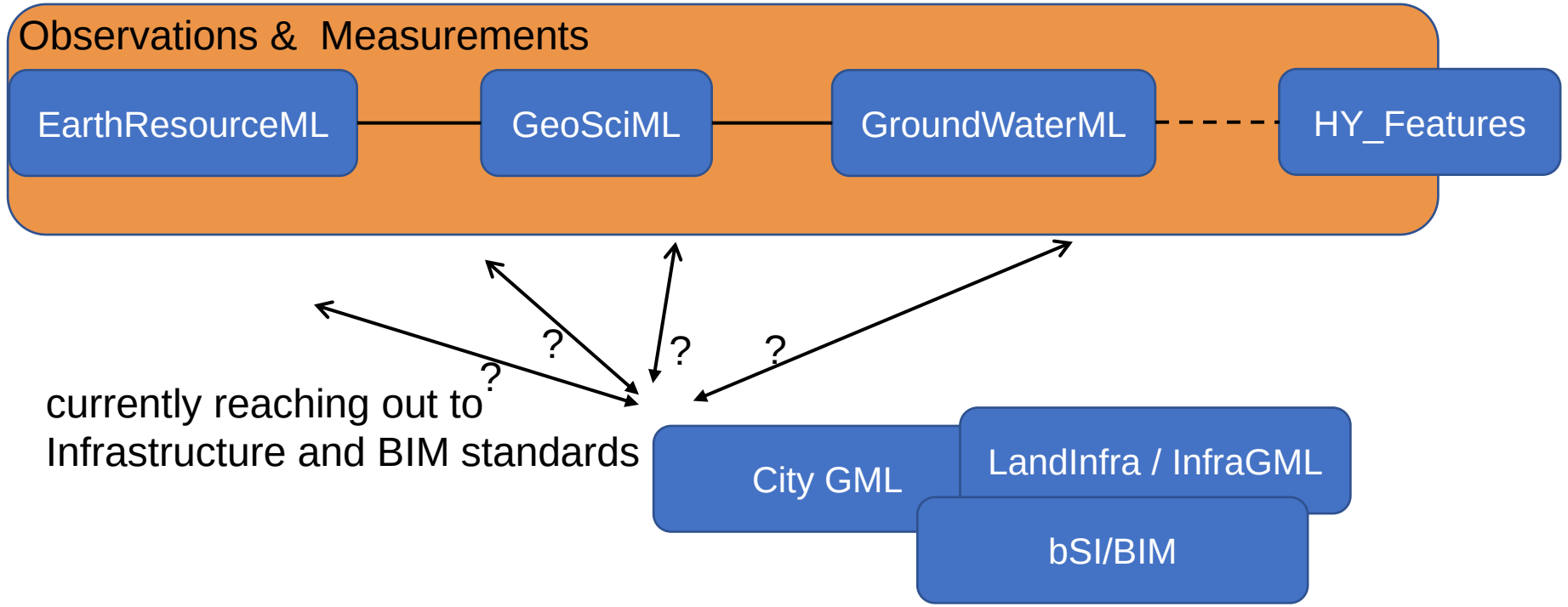
EU Air Quality Directive



Semantic interoperability

UML

- All those ‘OGC’ Geoscience Domain standards are linked



Note: Other could have been mentioned, like OGC WaterML2 Part 1& TimeseriesML, Soil Interoperability Experiment (IE), Borehole IE, etc…*

** https://github.com/opengeospatial/BoreholeIE*

Géosciences pour une Terre durable
brgm

Semantic interoperability

UML

- Lets meet some of them continued
  - INSPIRE Data Specification : all based on ISO 191xx series of standards, some themes are aligned with OGC standards

ANNEX: 1

- Addresses
- Administrative units
- Cadastral parcels
- Coordinate reference systems
- Geographical grid systems
- Geographical names
- Hydrography
- Protected sites
- Transport networks

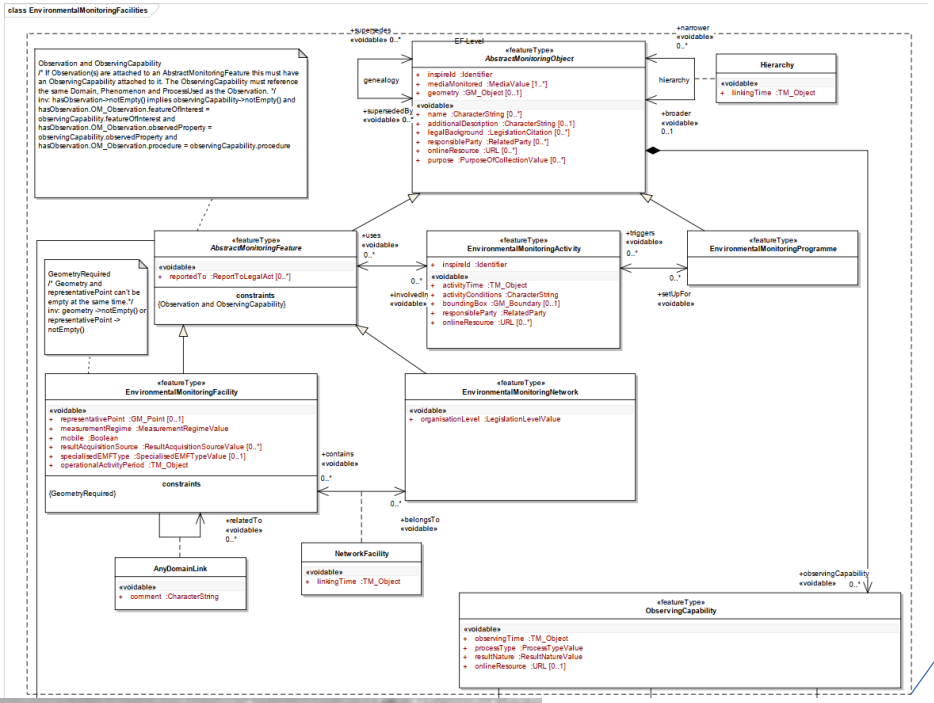
ANNEX: 2

- Elevation
- Geology
- Land cover
- Orthoimagery

Semantic interoperability

UML

- Lets meet some of them continued
  - INSPIRE Data Specification



All have their data model

ANNEX: 3

- Agricultural and aquaculture facilities
- Area management / restriction / regulation zones & reporting units
- Atmospheric conditions
- Bio-geographical regions
- Buildings
- Energy Resources
- Environmental monitoring Facilities
- Habitats and biotopes
- Human health and safety
- Land use
- Meteorological geographical features
- Mineral Resources
- Natural risk zones
- Oceanographic geographical features
- Population distribution and demography
- Production and industrial facilities
- Sea regions
- Soil
- Species distribution
- Statistical units
- Utility and governmental services

Semantic interoperability

UML

- Lets meet some of them continued
  - Need to mention all models defined in national information systems, Research Infrastructures, communities (ex: Energistics – not fully 191xx compliant but highly implemented, …)
  - That’s a lot of Lego® boxes to play with when starting a new project rather than inventing it’s own wheel !

Géosciences pour une Terre durable
brgm

Semantic interoperability

Semantic Web approaches

- Re the session you had with Benedicte Bucher
  - Open World Assumption -> ontologies
  - There are activities to have an “equivalent” ontology for some of the previously mentioned standards
    - Observations & Measurements, HY_Features, GeoSciML, GroundWaterML2.0

- The specific case of ‘nomenclatures’, ‘controlled vocabularies’ / ‘codeList’, ‘lexicons’

Semantic interoperability

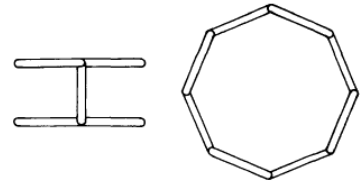
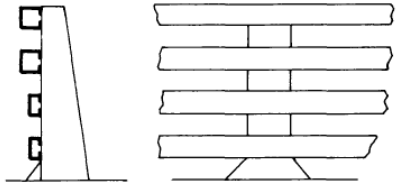
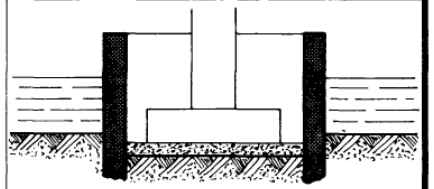
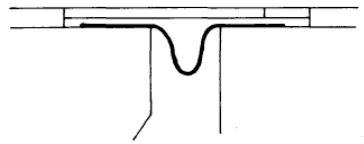
Semantic Web approaches

- The specific case of ‘nomenclatures’, ‘controlled vocabularies’ / ‘codeList’, ‘lexicons’

No. Carbone	Alcane R-H : préfixe	Alcane R-H : suffixe	Formule : C_nH_{2n+2}	Alkyle R : préfixe	Alkyle R : suffixe	Formule de R-	Abréviation
1	méth	ane	CH_4	méth	yle	CH_3-	Méth(a)
2	éth	ane	CH_3CH_3	éth	yle	CH_3CH_2-	Éth(a)
3	prop	ane	$CH_3CH_2CH_3$	prop	yle	$CH_3CH_2CH_2$-	Prop(a)
4	but	ane	$CH_3(CH_2)_2CH_3$	but	yle	$CH_3(CH_2)_2CH_2$-	But(a)
5	pent	ane	$CH_3(CH_2)_3CH_3$	pent	yle	$CH_3(CH_2)_3CH_2$-	Pent(a)
6	hex	ane	$CH_3(CH_2)_4CH_3$	hex	yle	$CH_3(CH_2)_4CH_2$-	Hex(a)
7	hept	ane	$CH_3(CH_2)_5CH_3$	hept	yle	$CH_3(CH_2)_5CH_2$-	Hept(a)
8	oct	ane	$CH_3(CH_2)_6CH_3$	oct	yle	$CH_3(CH_2)_6CH_2$-	Oct(a)
9	non	ane	$CH_3(CH_2)_7CH_3$	non	yle	$CH_3(CH_2)_7CH_2$-	Non(a)
10	déc	ane	$CH_3(CH_2)_8CH_3$	déc	yle	$CH_3(CH_2)_8CH_2$-	Déc(a)
11	undéc	ane	$CH_3(CH_2)_9CH_3$	undéc	yle	$CH_3(CH_2)_9CH_2$-	Undéc(a)
12	dodéc	ane	$CH_3(CH_2)_{10}CH_3$	dodéc	yle	$CH_3(CH_2)_{10}CH_2$-	Dodéc(a)
13	tridéc	ane	$CH_3(CH_2)_{11}CH_3$	tridéc	yle	$CH_3(CH_2)_{11}CH_2$-	Tridéc(a)

Code	Intitulés de la NAF rév. 2, version finale	Intitulés NAF rév. 2, en 65 caractères	Intitulés NAF rév. 2, en 40 caractères
SECTION A	AGRICULTURE, SYLVICULTURE ET PÊCHE	AGRICULTURE, SYLVICULTURE ET PÊCHE	AGRICULTURE, SYLVICULTURE ET PÊCHE
01	**Culture et production animale, chasse et services annexes**	**Culture et production animale, chasse et services annexes**	**Cult. & prod. animale, chasse & sce ann.**
01.1	**Cultures non permanentes**	**Cultures non permanentes**	**Cultures non permanentes**
01.11	Culture de céréales (à l'exception du riz), de légumineuses et de graines oléagineuses	Culture de céréales (sf riz) légumineuses, graines oléagineuses	Cult céréale, légumineuse, graine oléag.
01.11Z	*Culture de céréales (à l'exception du riz), de légumineuses et de graines oléagineuses*	*Culture de céréales (sf riz) légumineuses, graines oléagineuses*	*Cult céréale, légumineuse, graine oléag.*
01.12	Culture du riz	Culture du riz	Culture du riz
01.12Z	*Culture du riz*	*Culture du riz*	*Culture du riz*
01.13	Culture de légumes, de melons, de racines et de tubercules	Culture de légumes, de melons, de racines et de tubercules	Cult. légume, melon, racine & tubercule
01.13Z	*Culture de légumes, de melons, de racines et de tubercules*	*Culture de légumes, de melons, de racines et de tubercules*	*Cult. légume, melon, racine & tubercule*
01.14	Culture de la canne à sucre	Culture de la canne à sucre	Culture de la canne à sucre
01.14Z	*Culture de la canne à sucre*	*Culture de la canne à sucre*	*Culture de la canne à sucre*
01.15	Culture du tabac	Culture du tabac	Culture du tabac
01.15Z	*Culture du tabac*	*Culture du tabac*	*Culture du tabac*
01.16	Culture de plantes à fibres	Culture de plantes à fibres	Culture de plantes à fibres
01.16Z	*Culture de plantes à fibres*	*Culture de plantes à fibres*	*Culture de plantes à fibres*
01.19	Autres cultures non permanentes	Autres cultures non permanentes	Autres cultures non permanentes
01.19Z	*Autres cultures non permanentes*	*Autres cultures non permanentes*	*Autres cultures non permanentes*
01.2	**Cultures permanentes**	**Cultures permanentes**	**Cultures permanentes**
01.21	Culture de la vigne	Culture de la vigne	Culture de la vigne
01.21Z	*Culture de la vigne*	*Culture de la vigne*	*Culture de la vigne*

Nomenclature des parties d'ouvrages d'art en béton armé et précontraint © **1976 SETRA-LCPC**

Nom de la partie d'ouvrage	DEFINITION	Croquis ou photo.
BARRETTE (en paroi moulée)	ÉLÉMENT DE PAROI EN BÉTON OU EN BÉTON ARMÉ, MOULÉ DANS LE SOL OU PRÉFABRIQUÉ, ISOLÉ OU COMBINÉ AVEC D'AUTRES POUR FORMER UN PROFIL.	
BARRIÈRE (de sécurité)	DISPOSITIF DE SECURITÉ DESTINÉ A MAINTENIR SUR LA PLATE-FORME UN VÉHICULE LOURD EN PERDITION (ET REMPLISSANT ÉGALEMENT CE RÔLE POUR LES VÉHICULES LÉGERS).	
BATARDEAU	OUVRAGE DE PROTECTION, PROVISOIRE OU DÉFINITIF, PERMETTANT DE TRAVAILLER À L'AIR LIBRE PLUS BAS QUE LE NIVEAU DE L'EAU.	
BAVETTE	DISPOSITIF DÉFORMABLE PERMETTANT DE RECUEILLIR DES EAUX. EXEMPLE : BAVETTE SOUS JOINT DE CHAUSSÉE.	

Semantic interoperability

Semantic Web approaches

- The specific case of ‘nomenclatures’, controlled vocabularies’ / ‘codeList’, ‘lexicons’
  - Structured using WebSem/Linked Data Best Practice and made available for

Human and **Machines**

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Définition

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

```
@prefix schema: <https://schema.org/> .
@prefix ssd:    <http://www.w3.org/ns/sparql-service-description#> .
@prefix owl:    <http://www.w3.org/2002/07/owl#> .
@prefix xsd:    <http://www.w3.org/2001/XMLSchema#> .
@prefix skos:   <http://www.w3.org/2004/02/skos/core#> .
@prefix rdfs:   <http://www.w3.org/2000/01/rdf-schema#> .
@prefix qb:     <http://purl.org/linked-data/cube#> .
@prefix dgu:    <http://reference.data.gov.uk/def/reference/> .
@prefix ui:     <http://purl.org/linked-data/registry-ui#> .
@prefix dct:    <http://purl.org/dc/terms/> .
@prefix reg:    <http://purl.org/linked-data/registry#> .
@prefix api:    <http://purl.org/linked-data/api/vocab#> .
@prefix vann:   <http://purl.org/vocab/vann/> .
@prefix prov:   <http://www.w3.org/ns/prov#> .
@prefix foaf:   <http://xmlns.com/foaf/0.1/> .
@prefix cc:     <http://creativecommons.org/ns#> .
@prefix void:   <http://rdfs.org/ns/void#> .
@prefix adms:   <http://www.w3.org/ns/adms#> .
@prefix org:    <http://www.w3.org/ns/org#> .
@prefix odrs:   <http://schema.theodi.org/odrs#> .
@prefix env-ui: <http://environment.data.gov.uk/registry/structure/ui/> .
@prefix version: <http://purl.org/linked-data/version#> .
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix ldp:    <http://www.w3.org/ns/ldp#> .
@prefix time:   <http://www.w3.org/2006/time#> .
@prefix vs:     <http://www.w3.org/2003/06/sw-vocab-status/ns#> .
@prefix dc:     <http://purl.org/dc/elements/1.1/> .

<https://data.geoscience.fr/ncl/ObsProp/191>
        a                   <http://qudt.org/schema/qudt/QuantityKind> , <https://data.geoscience.fr/def/main#GroundwaterObservedProperty> , skos:Concept ,
        <https://data.geoscience.fr/def/main#PhysicalObservedProperty> ;
        rdfs:label          "Conductivité de l'eau à 25°C"@fr , "Water conductivity at 25°C"@en ;
        dct:description     " Water conductivity measured at 25°C"@en , " Conductivité électrique de l'eau mesurée ou corrigée à 25°C."@fr ;
        reg:category        <https://data.geoscience.fr/ncl/structure/Category/4> ;
        <http://qudt.org/2.1/schema/qudt#unit>
                <https://data.geoscience.fr/ncl/uom/463> ;
        owl:sameAs          <http://id.eaufrance.fr/par/1303> ;
        skos:exactMatch     <http://registry.it.csiro.au/def/environment/property/electrical_conductivity_water_at_25C> ;
        skos:inScheme       <https://data.geoscience.fr/ncl/ObsProp> ;
        skos:notation       "191" ;
        skos:prefLabel      "Water conductivity at 25°C"@en , "Conductivité de l'eau à 25°C"@fr ;
        skos:topConceptOf   <https://data.geoscience.fr/ncl/ObsProp> ;
        adms:status         <http://inspire.ec.europa.eu/registry/status/valid> .

<https://data.geoscience.fr/ncl/ObsProp/_191>
        a                   reg:RegisterItem ;
        rdfs:label          "Water conductivity at 25°C"@en , "Conductivité de l'eau à 25°C"@fr ;
        dct:dateAccepted    "2020-04-10T14:04:28.202Z"^^xsd:dateTime ;
        dct:dateSubmitted   "2020-04-10T14:03:04.89Z"^^xsd:dateTime ;
        dct:description     " Water conductivity measured at 25°C"@en , " Conductivité électrique de l'eau mesurée ou corrigée à 25°C."@fr ;
        dct:modified        "2021-12-02T09:50:48.802Z"^^xsd:dateTime ;
        reg:definition      [ reg:entity       <https://data.geoscience.fr/ncl/ObsProp/191> ;
                              reg:sourceGraph  <https://data.geoscience.fr/ncl/ObsProp/_191:5#graph>
                            ] ;
        reg:itemClass       <https://data.geoscience.fr/def/main#GroundwaterObservedProperty> , <http://qudt.org/schema/qudt/QuantityKind> , skos:Concept ,
        <https://data.geoscience.fr/def/main#PhysicalObservedProperty> ;
```

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Globally unique and persistent identifier

Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Globally unique and persistent identifier

Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

References to other vocabularies

References to other vocabularies

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

Géosciences pour une Terre durable

brgm

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Globally unique and persistent identifier

Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

References to other vocabularies

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

Géosciences pour une Terre durable

brgm

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Globally unique and persistent identifier

Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

skos:exactMatch => reference to a skos concept

References to other vocabularies

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

Géosciences pour une Terre durable

brgm

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Globally unique and persistent identifier

Définition

Descriptive prope

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conducti mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | observed property
unit	MicroSiemens par centimètre

skos:exactMatch => reference to a skos concept

References to other vocabularies

Entry: water electrical conductivity @ 25C

URI: http://registry.it.csiro.au/def/environment/property/electrical_conductivity_water_at_25C

water electrical conductivity @ 25C

CSIRO equivalent

Definition

broader	electrical conductivity of water | electric conductivity
description	water electrical conductivity @ 25C
feature of interest	liquid water
generalization	electric conductivity | electrical conductivity of water
label	water electrical conductivity @ 25C
pref label	water electrical conductivity @ 25C
source	eReefs
type	electricity and magnetism quantity kind | Concept | scaled quantity kind
unit	micro siemens per centimetre | milligrams per litre

Links

Has broader concept

- electric conductivity
- electrical conductivity of water

Feature of interest

- liquid water

Has more general quantity kind

- electric conductivity
- electrical conductivity of water

Has unit of measure

- micro siemens per centimetre
- milligrams per litre

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

Identifiant unique pérenne

Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l'eau mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

References to other vocabularies

Liens

Exact match pour

- electrical conductivity water at 25 c

In concept scheme

- Propriétés Observées

Est même que

- 1303

Est top concept de

- Propriétés Observées

Entrée: Conductivité de l'eau à 25°C

URI: https://data.geoscience.fr/ncl/ObsProp/191

Conductivité électrique de l'eau mesurée ou corrigée à 25°C.

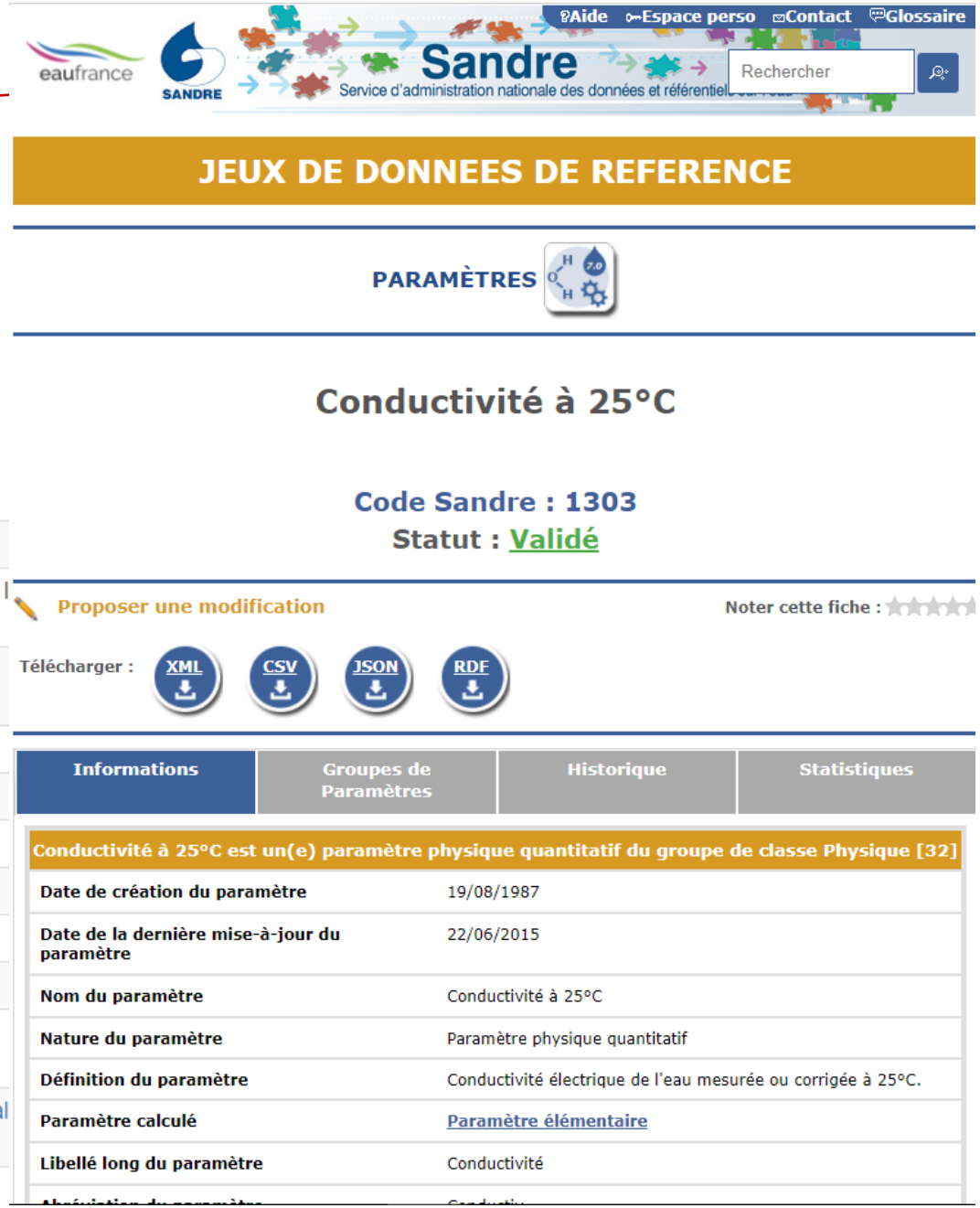
Définition

Descriptive properties

category	Eaux souterraines
description	Water conductivity measured at 25°C | Conductivité électrique de l mesurée ou corrigée à 25°C.
exact match	electrical conductivity water at 25 c
in scheme	Propriétés Observées
label	Conductivité de l'eau à 25°C | Water conductivity at 25°C
notation	191
pref label	Water conductivity at 25°C | Conductivité de l'eau à 25°C
same as	1303
status	Validé
top concept of	Propriétés Observées
type	quantity kind | groundwater observed property | Concept | physical observed property
unit	MicroSiemens par centimètre

References to other vocabularies

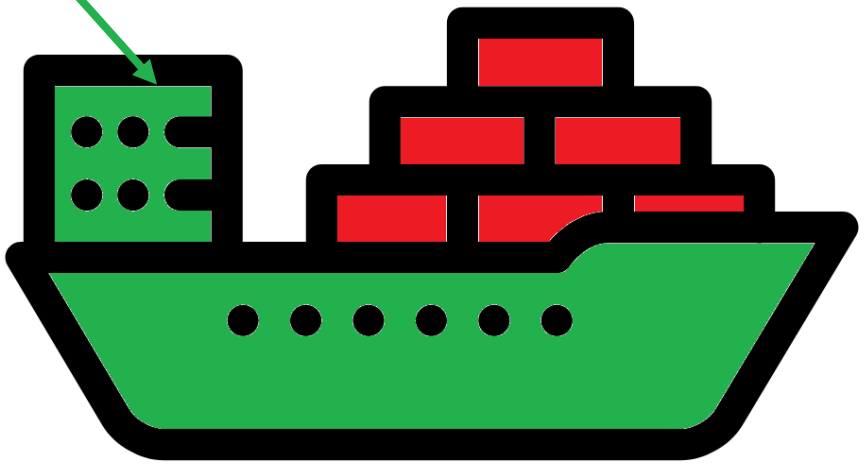
owl:sameAs => reference to a resource having similarity



Technical interoperability

2 ways to access data

- Through Webservices / API
- Direct access to a resource



Géosciences pour une Terre durable
brgm

Technical interoperability

Through Webservices / API

- A paradigm shift

3 July 2018

Latest version of Web Feature Service standard aligns with the current architecture of the Web and the joint OGC-W3C Spatial Data on the Web Best Practices.

The Open Geospatial Consortium (OGC) seeks public comment on the latest version of the Web Feature Service standard: WFS 3.0. The WFS 3.0 development has been conducted in a public manner with contributions from the wider geospatial community occurring through a GitHub repository and in a public hackathon.

An OGC Web Feature Service (WFS) offers the capability to retrieve, create, modify and query spatial data on the Web.

All versions of the WFS standard have so far used a Remote-Procedure-Call-over-HTTP architectural style using XML for any payloads as it was state-of-the-art in the late 1990s and early 2000s, when WFS was originally designed. The next version (WFS 3.0) is intended to provide a modern alternative and will specify a modernized service that aligns with the current architecture of the Web and the joint OGC-W3C Spatial Data on the Web Best Practices. The key changes relate to its architecture, encodings, reuse, modularization, schemas, and security.

As a result of this modernization, WFS 3.0 implementations will not be backwards compatible with WFS 2.0 implementations per se. However, a design goal is to define WFS 3.0 in a way so that the WFS 3.0 interface can be mapped to an WFS 2.0 implementation.

WFS 3.0 is intended to be simpler and more modern, but still an evolution from the previous versions and their implementations.

The WFS standard is a multi-part document. This first part specifies the core capabilities that every WFS has to support and is restricted to read-access to spatial data. Additional capabilities that address specific needs will be specified in additional parts. Examples include support for creating and modifying data, more complex data models, richer queries, and additional coordinate reference systems.

An overview of the modernization of WFS3.0, including the key changes, is available in the GitHub repository: The next version of WFS - an overview.

Technical interoperability

Through Webservices / API

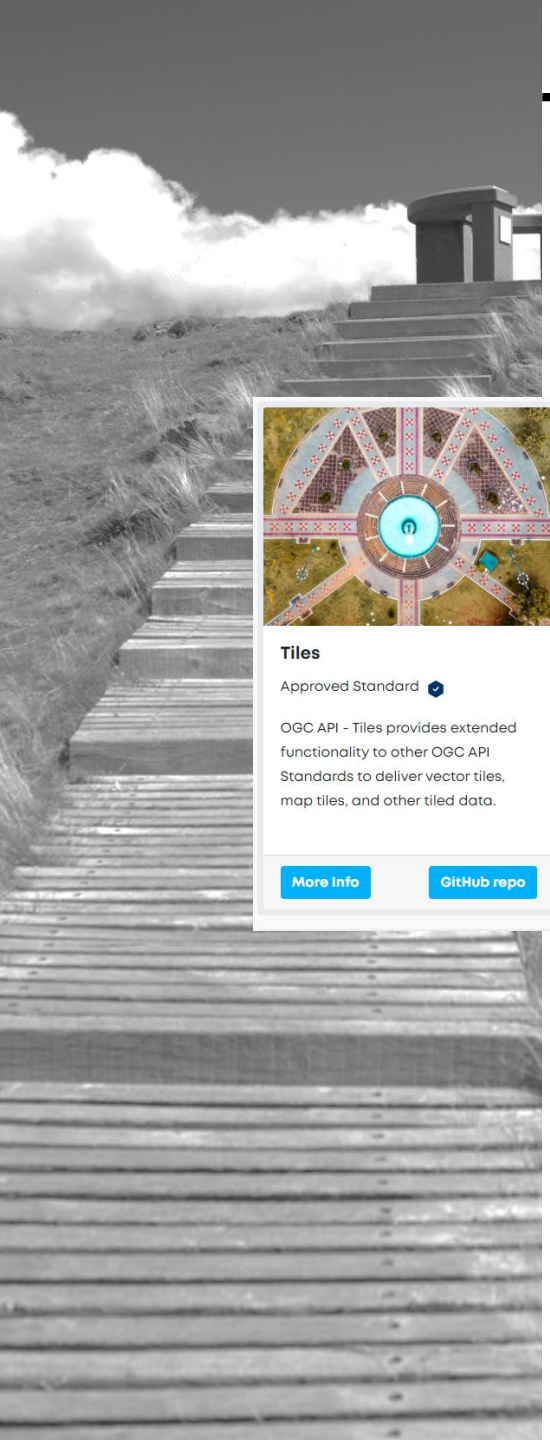
- A paradigm shift triggered by
  - The fact that (geo) data was under-used by the web community even after big pushes of initiatives likes INSPIRE
  - The generalisation of Resource oriented architecture (RESTful APIS) based on resource identification through URIs and using HTTP protocol to interact with them
  - The raise in maturity of frameworks such as OData and Swagger/OpenAPI
  - ⇒ bottom line: the web community was looking away from the previous approaches

  - The collaboration between OGC/W3C initiated around 2014 and producing important milestones
    - Data on the Web Best Practices : https://www.w3.org/TR/dwbp/
    - Spatial Data on the Web Best Practices : https://www.w3.org/TR/sdw-bp/

- This paradigm shift is valid for all the previous generations OGC Web Services (OWS stack)
  - Most of the new APIs are now under 'OGC API – xxx' (ex : WFS 3 is now OGC API – Features)

Technical interoperability

Through Webservices / API



Tiles

Approved Standard

OGC API - Tiles provides extended functionality to other OGC API Standards to deliver vector tiles, map tiles, and other tiled data.

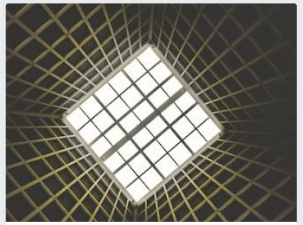
More Info | GitHub repo

Processes

Approved Standard

OGC API - Processes allows for processing tools to be called and combined from many sources and applied to data in other OGC API resources though a simple API.

More Info | GitHub repo



Coverages

OGC API - Coverages allows discovery, visualization and query of complex raster stacks and data cubes.

More Info | GitHub repo

APIs for the Web

Features

Approved Standard

OGC API - Features - Part 1: Core and Part 2: Coordinate Reference Systems by Reference are both publicly available.

More Info | GitHub repo

Common

OGC API - Common provides those elements shared by most or all of the OGC API standards to ensure consistency across the family. The candidate standard will soon be released for public review.

More Info | GitHub repo

EDR

Approved Standard

Environmental Data Retrieval (EDR) API provides a family of lightweight interfaces to access Environmental Data resources. Each resource addressed by an EDR API maps to a defined query pattern.

More Info | GitHub repo

Records

OGC API - Records updates OGC's Catalog Services for the Web by building on the simple access to content in OGC API - Features.

More Info | GitHub repo

Styles

The OGC API - Styles defines a Web API that enables map servers, clients as well as visual style editors, to manage and fetch styles...

More Info | GitHub repo

Maps

OGC API - Maps offers a modern approach to the OGC Web Map Service (WMS) standard for provision map and raster content.

More Info | GitHub repo

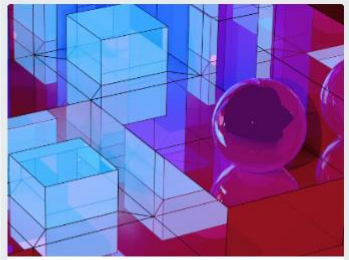
Technical interoperability

- Through Webservices / API

Moving Features

OGC API - Moving Features defines an API that provides access to data representing features that move as rigid bodies.

More Info GitHub repo



3D GeoVolumes

OGC API - 3D GeoVolumes facilitates efficient discovery of and access to 3D content in multiple formats based on a space-centric perspective.

More Info GitHub repo

DGGS

Enables applications to organise and access data arranged according to a Discrete Global Grid System (DGGS).

More Info GitHub repo

Routes

Enables applications to request routes in a manner independent of the underlying routing data set, routing engine or algorithm.

More Info GitHub repo

Joins

OGC API - Joins supports the joining of data, from multiple sources, with feature collections or directly with other input files.

More Info GitHub repo

APIs for the IoT

SensorThings

The OGC SensorThings API provides an open, geospatial-enabled and unified way to interconnect Internet of Things (IoT) devices, data, and applications over the Web.

More Info GitHub repo

Technical interoperability

Through APIs

- Each API instance described by a documentation that is meaningful for the Web
- No retrocompatibility is not an issue
- Targetting « JSON family » (often (Geo)JSON) representation

- Hypermedia (HATEOAS)
  - Hypermedia as the Engine of Application State
  - Within API operation
  - Within data structure returned: Sensor Things API response is a perfect example

  ⇒ "A REST client needs little to no prior knowledge about how to interact with an application or server beyond a generic understanding of hypermedia." (Wikipedia)

  ⇒ A client could work by following links between resources, that's the way of the ~~modern~~ Web

Technical interoperability

Through APIs - exemples

- OGC API – Features

GeoServer

GeoServer Feature Collections

This document lists all the collections available in the Features service.
This document is also available as application/x-yaml, application/json.

eposb:Borehole

- **Title**: Borehole
- **Geographic extents**:
  - 41.325, -5.15, 51.118, 9.624.
- Data as HTML. Collection items are also available in the following formats: --Please choose an option--
- Queryables as HTML.

gsmlp:BoreholeView

- **Title**: BoreholeView
- **Geographic extents**:
  - -64.656, -21.388, 139.535, 87.933.
- Data as HTML. Collection items are also available in the following formats: --Please choose an option--
- Queryables as HTML.


```
{
   type: "FeatureCollection",
  ▾ features: [
    ▾ {
          type: "Feature",
          id: "0001000001",
        ▾ geometry: {
            type: "Point",
          ▾ coordinates: [
                [redacted],
                [redacted]
            ]
        },
        ▾ properties: {
            "@featureType": "Borehole",
          ▾ identifier: {
                value: "BSS000AAAA",
                "@codeSpace": http://www.ietf.org/rfc/rfc2616
            },
          ▾ type: {
                "@href": http://vocabulary.odm2.org/samplingfeaturetype/borehole/,
                "@title": "borehole"
            },
          ▾ sampledFeature: [
            ▾ {
                  "@href": https://sweet.jpl.nasa.gov/2.3/realmEarthReference.owl#EarthLithosphere,
                  "@title": "Lithosphere"
              }
            ],
          ▾ shape: {
                "@dataType": "shape",
              ▾ Point: {
                    type: "Point",
                  ▾ coordinates: [
                        [redacted],
                        [redacted]
                    ]
                }
            },
          ▾ custodian: {
                "@dataType": "Custodian",
              ▾ custodian: {
                    "@dataType": "CI_ResponsibleParty",
                    organisationName: "BRGM",
                  ▾ role: {
                        "@codeListValue": "custodian",
                        "@codeList": http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml
                    }
```

Technical interoperability

Through APIs - exemples

- OGC API – Features
  - Contrary to SensorThings API, OGC API – Features does not come with a mandatory Feature model to use.

  It just requires the data model one wants to serve to be about ‘Features’; which does not say much about which semantics to use for Features in a specific domain (ex : Borehole, Geologic Unit, River, Station, …).
  - To generate the payload from the previous page using Geoserver we used
    - https://docs.geoserver.org/stable/en/user/community/features-templating/index.html : to configure the output payload to respect the semantic standards
    - https://docs.geoserver.org/stable/en/user/community/smart-data-loader/index.html could help in case the source dataset is a relational database and not a flat table

Technical interoperability

Through APIs - exemples

- OGC Sensor Things API
  - Comes with a Feature model to respect (compliant to Observations & Measurements) => see dedicated OMS SensorThings API presentation (4_OMS_ST_API).


```
{
  "@iot.nextLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams?$skip=100",
  "value": [
    {
      "name": "Dichloropropène-2,3 in Eau on Eau brute at LA GRANDE NOUE D'HERMÉ A GOUAIX 1 with method Qualité de l'eau - Dosage par chromatographie en phase gazeuse d'un certain nombre d'hydrocarbures aromatiques monocycliques, du naphtalène et de divers composés chlorés par dégazage, piégeage et désorption thermique (T90-129/NF EN ISO 15680 01/2004)",
      "description": "Dichloropropène-2,3 in Eau on Eau brute at LA GRANDE NOUE D'HERMÉ A GOUAIX 1 with method Qualité de l'eau - Dosage par chromatographie en phase gazeuse d'un certain nombre d'hydrocarbures aromatiques monocycliques, du naphtalène et de divers composés chlorés par dégazage, piégeage et désorption thermique (T90-129/NF EN ISO 15680 01/2004)",
      "properties": {↔},
      "observationType": "http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement",
      "observedArea": {
        "type": "Point",
        "coordinates": [
          48.457967041,
          3.296382646
        ]
      },
      "phenomenonTime": "2010-01-04T00:20:00.000Z/2011-11-02T11:55:00.000Z",
      "Sensor@iot.navigationLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams(1142553)/Sensor",
      "Thing@iot.navigationLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams(1142553)/Thing",
      "Observations@iot.navigationLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams(1142553)/Observations",
      "unitOfMeasurement": {↔},
      "ObservedProperty@iot.navigationLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams(1142553)/ObservedProperty",
      "@iot.id": 1142553,
      "@iot.selfLink": "https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/Datastreams(1142553)"
```

Technical interoperability

Through APIs – some considerations

- RESTful
  - A RESTful API really make use of HTTP verbs to interact with it
  - And NOT ONLY GET => ok reading is nice but a truly RESTful API allows much more
  - PUT, PATCH, « DELETE » and other are also useful

⇒ A really good example OGC SensorThings API

Technical interoperability

Through APIs – some considerations

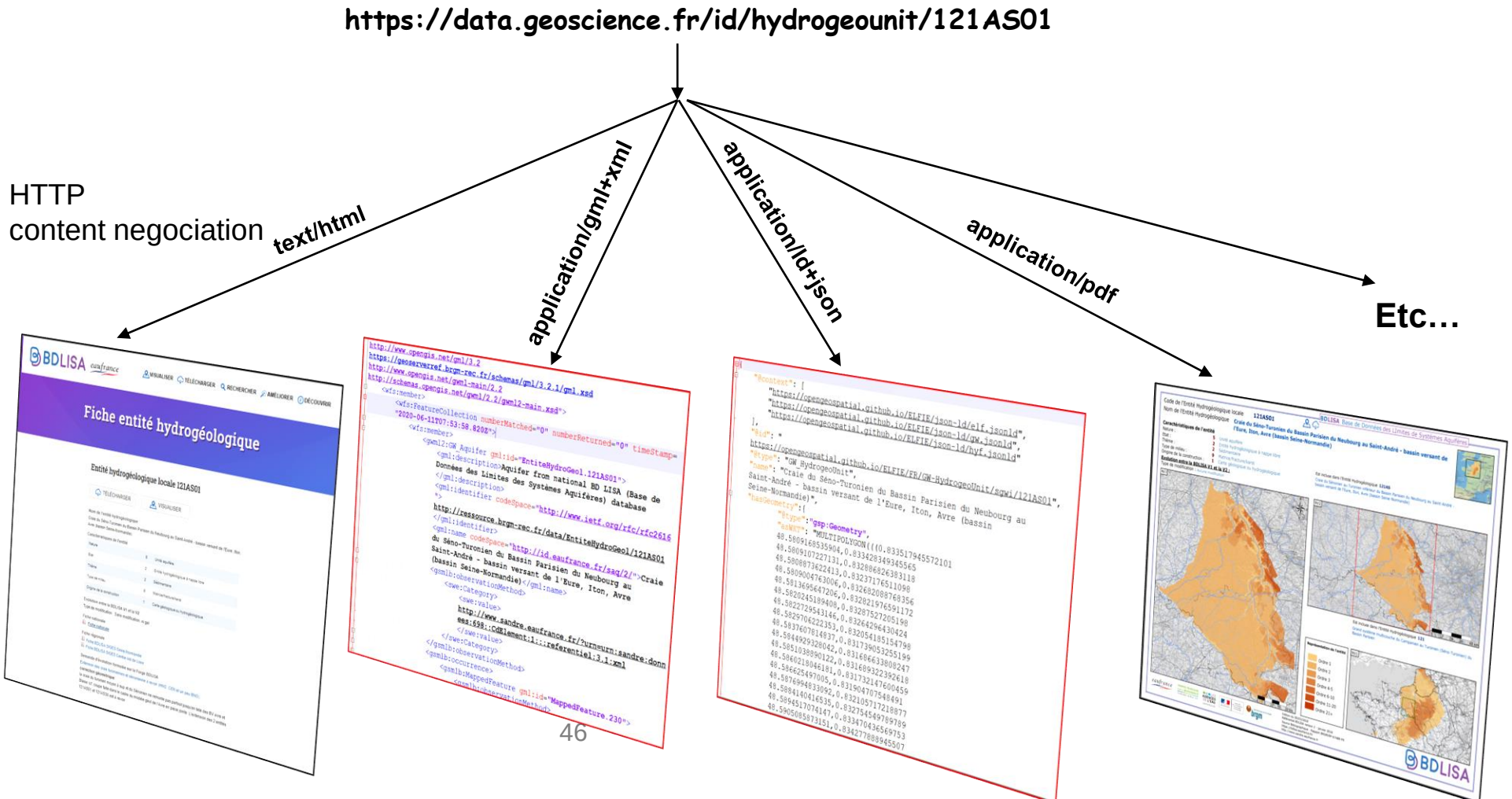
- Deploying a home made/brewd RESTful API using Swagger/OpenAPI or OData is NOT playing the FAIR data / interoperablity game
  - Ex : setting up an API to access River in France and the USA
    - In France could be /.../ecoulement/coursEau ("operationId": "getResultats",)
    - In the USA /.../flow/waterbodies ("operationId": "getFeatures")
  - Each operation awaiting its own parameters to execute domain queries
    - River Network Semantics : In France based on the BD Topage semantics, in the USA on NHD+,
    - Generic parameters : BBOX, outputFormat
  - Each API returning a payload with its own 'local' semantics (re BD Topage VS NHD+)
  - ⇒ How can on share information in a Machine2Machine approach with no mapping/re-wiring ?
  - ⇒ Semantic and technical interoperability are not provided

  - ⇒ Advised solution
  - API : OGC API – Features
  - Semantics : OGC/WMO Hy_Features which by specifications is mapped to both US, France, INSPIRE models.

Technical interoperability

Direct access to a resource and Linked Data

- Resolvers allow to externally reference a resource via its URI (a PID)

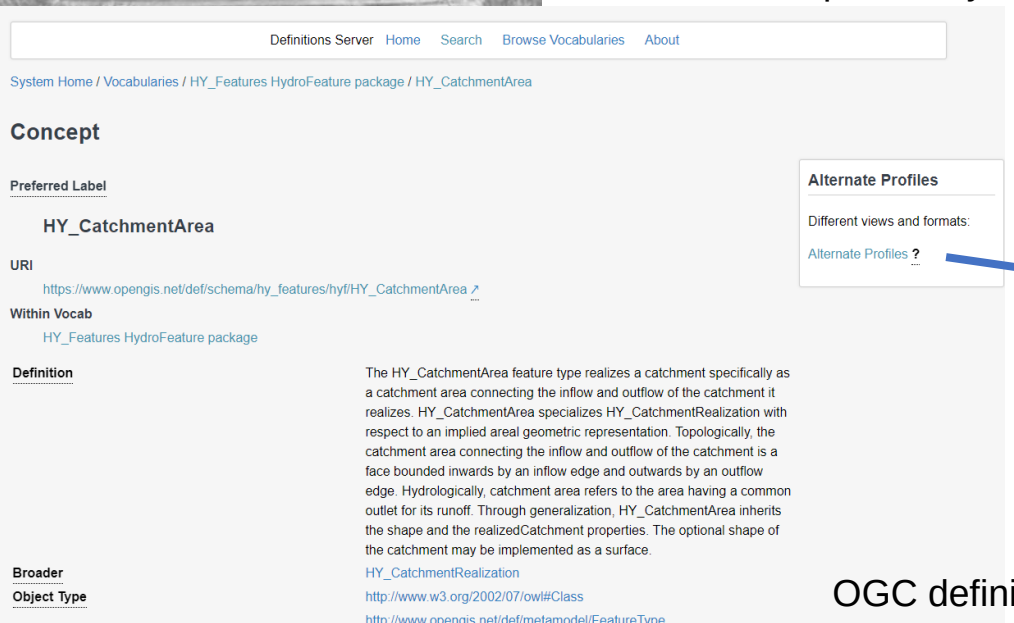


Technical interoperability

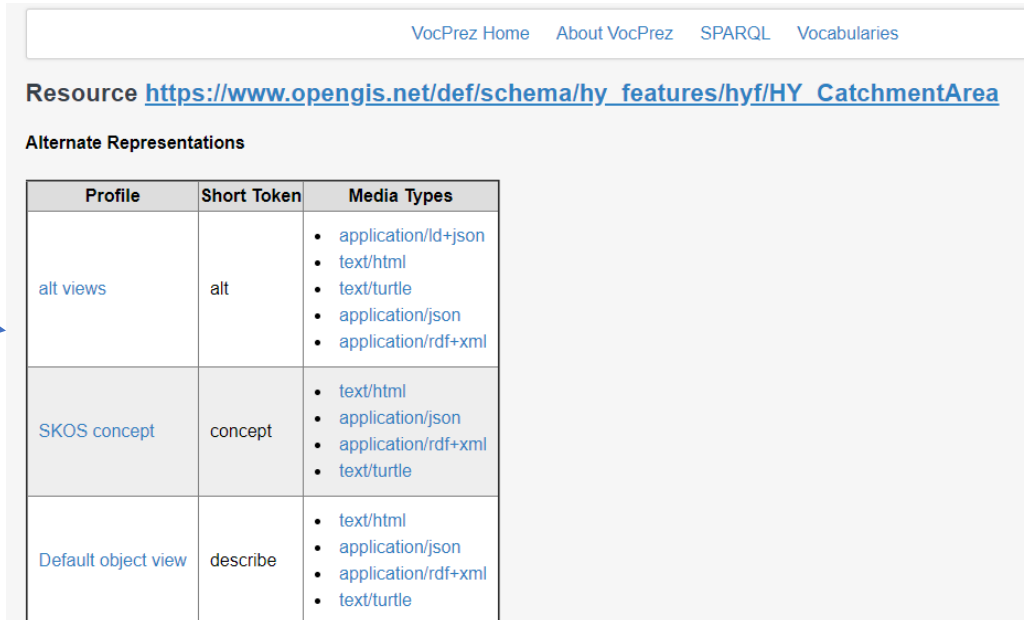
Direct access to a resource and Linked Data

- HTTP content negociation
  - Used in everyday life (standard web browser defines the media type and language)
  - But is highly useful for Machine2Machine data exchange

  - Currently evolving to '[Content negociation by profile]'. Interesting additions
    - the possibility for a resource and for the same media-type to serve it according to different model (called profile)
    - the possibility for a client to 'test/probe' the available media-type x profile x etc… availables



OGC definition server example



Thank you

s.grellet@brgm.fr

Thanks to

Hélène Bressan

h.bressan@brgm.fr

Abdelfettah Feliachi

https://www.linkedin.com/in/abdelfettah-feliachi/

Mickaël Beaufils

M.Beaufils@brgm.fr