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Achieving FAIR water quality data exchange thanks to international OGC water standards

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Sylvain Grellet, Kathi Schleidt, Hylke van Der Schaaf. Achieving FAIR water quality data exchange thanks to international OGC water standards. ESIP: Information technology & Interoperability (IT&I) committee, ESIP, May 2024, ESIP: Virtual meeting, United States. hal-04592134

HAL Id: hal-04592134

<https://brgm.hal.science/hal-04592134v1>

Submitted on 29 May 2024

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Achieving FAIR water quality data exchange thanks to international OGC water standards

Sylvain Grellet – BRGM

09/05/2024 - ESIP - Information Technology and Interoperability Deep Dives

With support from

Hylke van der Schaaf - Fraunhofer IOSB

Katharina Schleidt - DataCove



Achieving FAIR water quality data exchange thanks to international OGC water
standards



What is OGC?

A hub for thought leadership, innovation, and standards for all things related to location

Our Vision

Building the future of location with community and technology for the good of society

Our Mission

Make location information Findable, Accessible, Interoperable, and Reusable (FAIR)

Our Approach

A proven collaborative and agile process combining consensus-based standards, innovation project, and partnership building



Who Are Our Members?

Commercial

Business Development

Global: Brand Exposure

Competitive Technical Advantage

Funding for Innovation

Government

Innovation & Market Support

International Partnerships

Trusted Advice

Operational Policy

Support & Certification

Research & Academia

Applied Research Partners

International Collaboration

Funding for Innovation

Citations



OGC Hydro Domain Working Group ?



- Joint OGC – World Meteorological Organization (OMM / WMO) group
 - Memorandum of Understanding between OGC - WMO
- Target: water data standards => WaterML 2.0 suite : <https://www.ogc.org/standard/waterml/>
- Organizing Interoperability Experiments - (IEs) focused on the water sub-domains

- Entry point

https://external.ogc.org/twiki_public/HydrologyDWG/WebHome

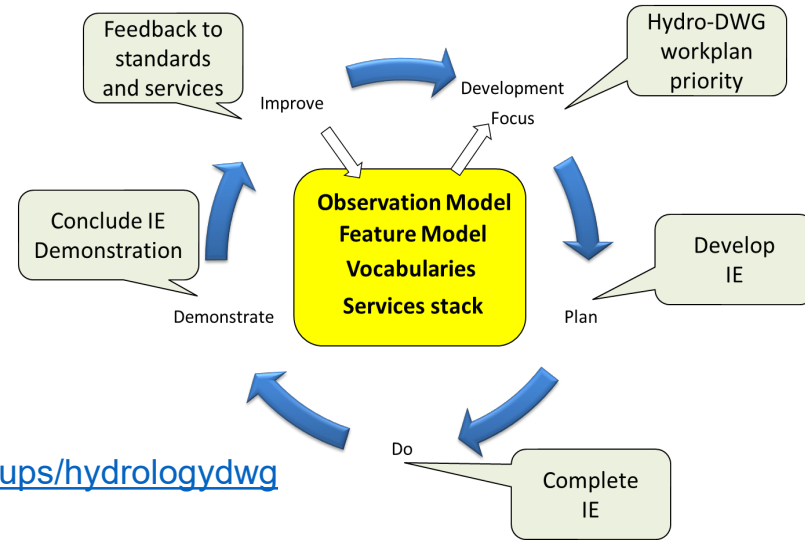
- Has a Research Data Alliance ‘sister group’
=> ‘Global Water Information Interest Group’

- Chairs

- Tony Boston (Australia)
- Silvano Pecora (Italy) – WMO Liaison
- David Blodgett (USA)

<http://www.opengeospatial.org/projects/groups/hydrologydwg>

Iterative Development



Group dynamics

- A long history of joint activities
 - 2003 - Earth Systems Science Domain Working Group (DWG)
 - 2009 - Hydrology DWG
 - 2011 - Groundwater Interoperability Experiment (IE)
 - 2011 - Water Information Services Concept Development Study
 - 2011 - Surface Water Interoperability IE
 - 2012 - Hydrology Forecasting IE
 - 2013 - Climate-Hydrology Information Sharing Pilot
 - 2013 - GroundWater IE2
 - 2014 - Water ML 2.0 Standards Working Group (SWG)
 - 2015 - Hydrographic Features SWG
 - 2015 - Research Data Alliance Global Water Information IG (Hydro DWG sister group)
 - 2016 - Groundwater SWG
 - 2017 - Geoscience DWG
 - 2018 - Environmental Linked Features IE (ELFIE)
 - 2019 - Borehole IE
 - 2021 - Second ELFIE (SELFIE)
 - 2022 - Water Quality IE => on going

Group dynamics

- Un long history of meetings

First 5 years: Meetings 2008 - 2013

- OGC TC Meeting - Atlanta - 17 September 2008
- OGC TC Meeting - Valencia - 4 December 2008
- OGC TC Meeting - Athens - 30 March 2009
- OGC TC Meeting - Boston - 22 June 2009
- OGC TC Meeting - Darmstadt - 29 September 2009
- OGC TC Meeting - Mountain View - 8 December 2009
- 1st Hydrology DWG Workshop - Ispra - 15-18 March 2010
- OGC TC Meeting - Silver Spring - 15 June 2010
- OGC TC Meeting - Toulouse - 22 September 2010
- Hydrology DWG Workshop - Toulouse - 21-22 September 2010
- OGC TC Meeting - Sydney - 1 December 2010
- OGC TC Meeting - Bonn - 2 March 2011
- 2nd Hydrology DWG Workshop - Delft - 11-14 April 2011
- OGC TC Meeting - Taichung - 15 June 2011
- OGC TC Meeting - Boulder - 19-20 September 2011
- OGC Oceans/Met/Hydro Water Cycle Summit - 21 September 2011
- OGC TC Meeting - Brussels - 29 November 2011
- OGC TC Meeting - Austin - 19 & 21 March 2012
- 3rd Hydrology DWG Workshop 2012 - Reading - 25-28 June 2012
- OGC TC Meeting - Redlands - 16 January 2013
- 4th Hydrology DWG Workshop 2013 - Quebec City - 17-21 June 2013
- OGC TC Meeting - Frascati - 23 September 2013

Meetings 2014 and later:

- OGC TC Meeting - Arlington - 24-28 March 2014
- OGC TC Meeting - Geneva - 10-14 June 2014
- 5th Hydrology DWG Workshop 2014 - New York - 11-15 August 2014
- Training workshop at 11th International Hydroinformatics Conference - Standardization of Water Data Exchange: [WaterML 2.0 and Beyond](#) - New York - 16 August 2014
- OGC TC Meeting - Boulder - 3 June 2015
- OGC Water Data Summit - Boulder TC - 3 June 2015
- OGC TC Meeting - Nottingham - 17 September 2015
- 6th Hydrology DWG Workshop 2015 - Orleans - 21-25 September 2015
- OGC TC Meeting - Sydney - 2 December 2015
- OGC TC Meeting - Washington - March 2016
- 7th Hydrology DWG Workshop 2016 - Koblenz - 13-17 June 2016
- OGC TC Meeting - Dublin - June 2016
- OGC TC Meeting - Delft - March 2017
- 8th Hydrology DWG Workshop 2017 - Tuscaloosa - 20-23 June 2017
- OGC TC Meeting - St John's - June 2017
- OGC TC Meeting - Palmerston North - December 2017
- OGC TC Meeting - Orleans - March 2018
- OGC TC Meeting - Stuttgart - September 2018
- 9th Hydrology DWG Workshop 2018 - Geneva - 17-20 September 2018
- OGC TC Meeting - Charlotte - December 2018
- OGC TC Meeting - Leuven - June 2019
- Session on HDWG during the ISDE11 - Florence - September 2019 - [conference paper](#)
- HydroDWG Seminar January 2021
- HydroDWG Seminar March 2021 - WQ Data
- HydroDWG Seminar August 2021 - Mainstems
- HydroDWG OGC Member Meeting - December 2021
- HydroDWG OGC Member Meeting - March 2022
- GWML2 Workshop March 2022
- Water Quality Workshop March 2022
- HydroDWG OGC Member Meeting - June 2022
- HydroDWG OGC Member Meeting - October 2022
- HydroDWG OGC Member Meeting - February 2023
- HydroDWG Spring 2023 - May 2023

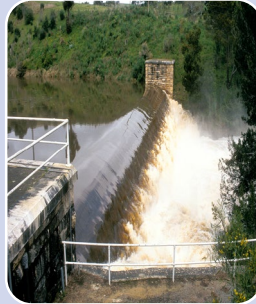


Group dynamics

- Community
 - Members all across the world
 - Members from different organization types
 - Public administrations
 - Public research organizations
 - International organization
 - Private companies
- Some examples
 - NR-Can, GSC, USGS, US EPA, CUASHI, SDSC, BRGM, UK CEH, DELTARES, GRDC, BaFG, Univ Tartu, Fraunhofer IOSB, DataCove, NIWA/LAWA (NZ), Federation University (Australia), BoM Australia, CSIRO, ...
 - WMO, UNESCO, ...
 - Kisters, 52°N, Aquatic Informatics, ...

A suite of standards

- WaterML2.0
 - Open and documented
 - implemented in WMO Information System and in many organizations : UNESCO, USGS, US EPA, NrCan, NIWA, BRGM, etc...
 - And in opensource tools : CUASHI Hydro-Server, Kisters, 52°N etc...
 - Updated with a regular contribution from projects involving Hydro DWG partners



Part 1 -
Timeseries

Part 2 –
Ratings,
Gaugings and
Sections

Part 3 –
Surface water
features

Part 4 –
Groundwater

Part 5 –
Water quality
(best practice)

Soon to be updated
by the Water
Quality IE



Achieving FAIR water quality data exchange thanks to

international OGC water standards

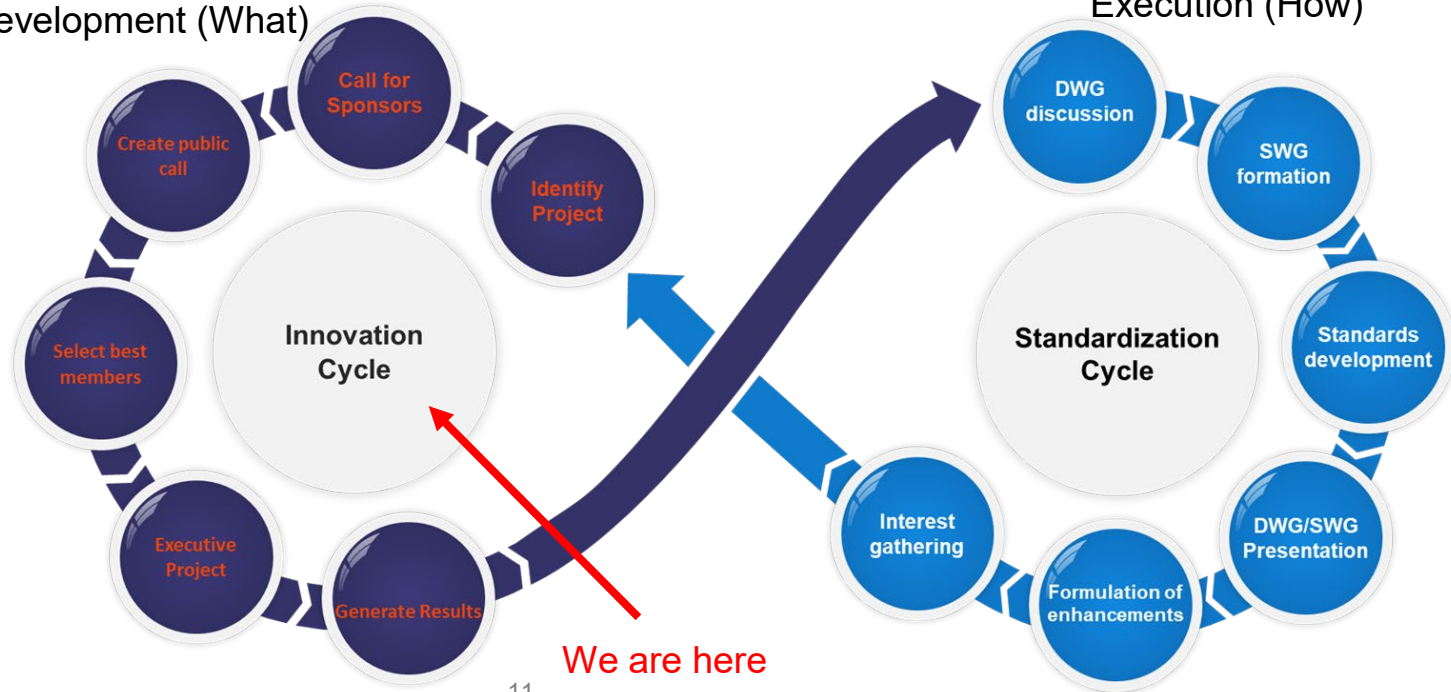
=> The OGC Water Quality Interoperability Experiment

OGC Interoperability Experiment (IE) ?

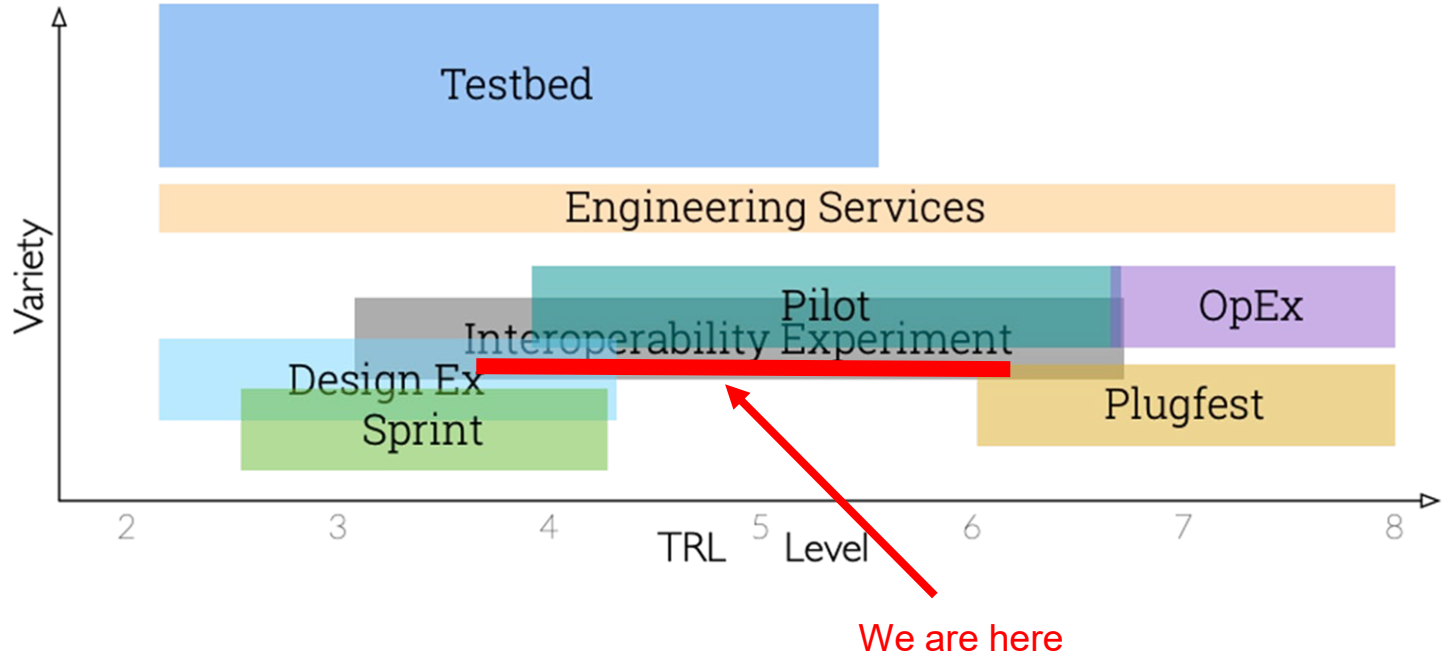
- OGC Innovation Continuum

Innovation Roadmap
Development (What)

Innovation Roadmap
Execution (How)



OGC Interoperability Experiment (IE) ?



OGC Interoperability Experiment (IE) ?

- Applied research initiative led by OGC members and supported by OGC staff
 - ⇒ Most of the time building on the current standards and best practices : the 'OGC Baseline' (pushing them to their limits / applying them to a new domain)
- Non-OGC member participation is allowed (usually as observers)
 - ⇒ In several IEs: GitHub + mailing list + meetings are open
 - ⇒ so the 'observers' can be really active
- Results documented in Engineering Report(s) or other OGC documents and generally used to define new Standardization work.
 - ⇒ Some lead to Change Request to the 'OGC Baseline'
 - ⇒ Some to Best Practices in applying it
 - ⇒ Some fill in gaps in the 'OGC Baseline' proposing document ready for the standardization process: exactly what happened to all the WaterML2.0 series of standards

It's during the IE that the group decides what the output will be : through experimentation

OGC Water Quality IE set up

- Third time the topic is proposed within the OGC Hydro Domain Working Group

- Enough momentum and interest from parties

=> WMO-UNEP-WHO-UNESCO Water Quality workshop in March 2022 (29-31)

https://external.ogc.org/twiki_public/HydrologyDWG/WaterQualityWorkshopSprint2022

=> confirmation of the necessity and organizations interest. Identification of interested parties and IT challenges

Discussion on the best approach => an OGC Interoperability Experiment

- Water Quality IE inception

=> Charter, call for participation, kick-off (20/09/2022)

Co-chairs : Sylvain Grellet (BRGM), Kyle Onda (Lincoln Institute)

Since then :

- Starting point : <https://github.com/opengeospatial/WaterQualityIE>
- Weekly meetings
- Shared material
 - Rolling meeting minutes document,
 - One focal point for UML models
 - Shared deployment documentation initiated
- Note : shared images in that presentation represent **Work In Progress** currently being tested

The Engineering Report will summarize the group conclusions



Use Cases identification and work methodology

	Org	Fol Type: Water (Surface and Ground together at this stage)			
Method	<i>Observed Property group</i>	Quantity	Physical properties	Chemistry	Biology
	Samples	Here as a support to WQ	1	2	3
	Sensors				
	Hydro Models				
	Remote Sensing				

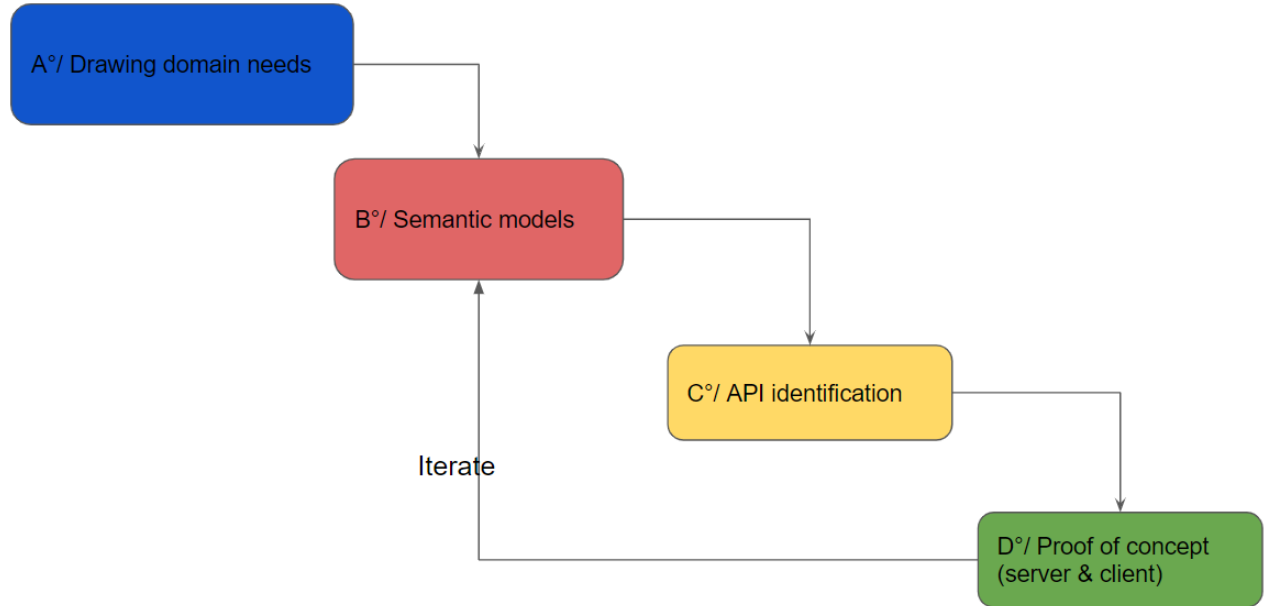
Fol = Feature Of Interest = the real world feature on which observation is made

- Water Quality Use Case prioritisation
 - Physical Properties (ex : Temperature, Conductivity), Chemistry
 - + Water Quantity as a support to Water Quality
 - *Out of scope this IE : Biology (taxa observation), Hydro Models, Remote Sensing*

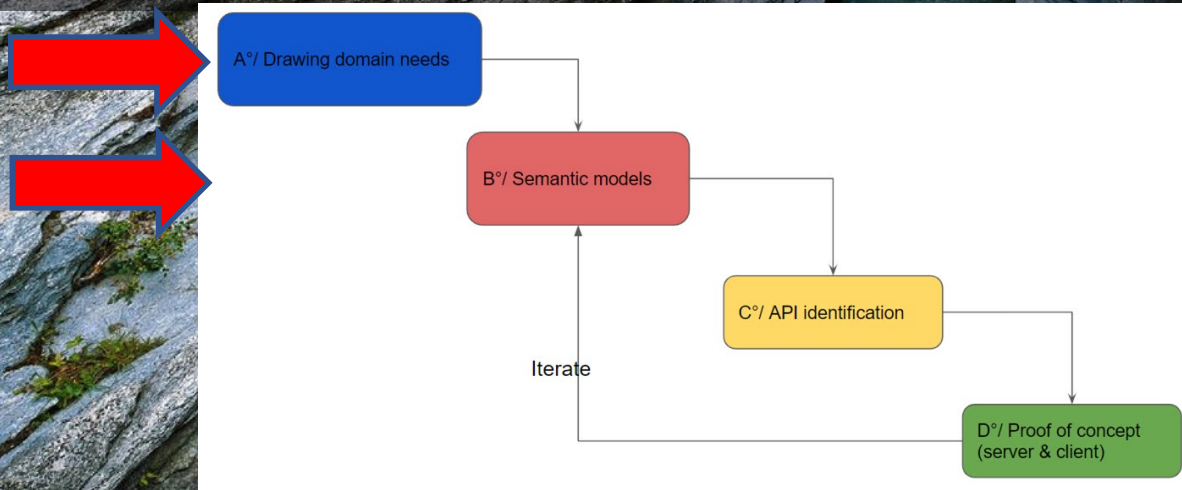


Use Cases identification and work methodology

Rationale (per Use Case)

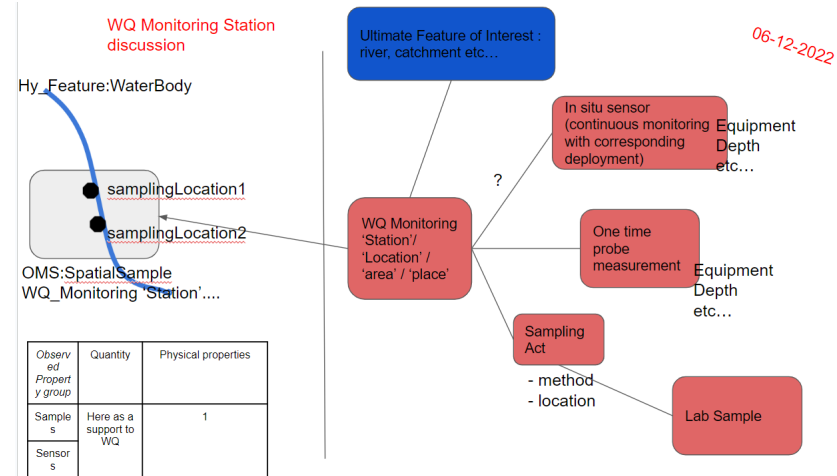
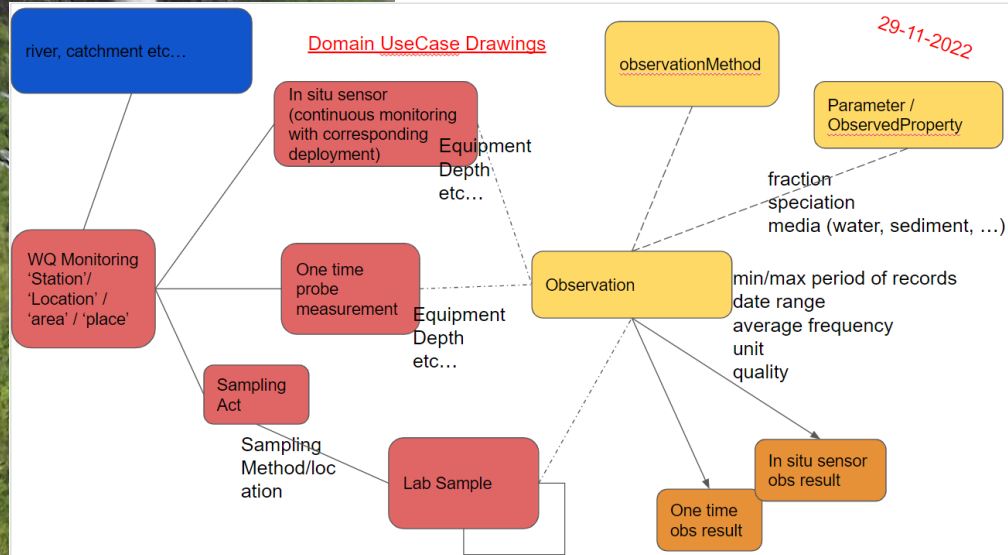


FAIR water quality data exchange thanks to international OGC water standards



Conceptual Modelling

- Step 1°/ Express the domain need stemming from the UseCases



Conceptual Modelling

- Step 2°/ Identify the standards in the OGC standard baseline to build on
 - 2 OGC-WMO water standards : GroundWaterML2.0 & HY_Features
 - THE OGC-ISO standard for Observations & Samples : ISO 19156:2023 : Observations, measurements and samples

OGC® DOCUMENT: 16-032R3
External identifier of this OGC® document: <http://www.openis.net/doc/IS/GWML/2.2.1>

OGC®
Making location count.

OGC WATERML 2: PART 4 - GROUNDWATERML 2 (GWML2)

STANDARD Implementation
APPROVED

Version: 2.2.1
Submission Date: 2019-04-15
Approval Date: 2019-09-15
Publication Date: 2021-01-20
Editor: Sylvain Brodard

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OGC® WaterML 2: Part 3 - Surface Hydrology Features (HY_Features) - Conceptual Model

Open Geospatial Consortium

Submission Date: 2017-08-17

Approval Date: 2017-10-16

Publication Date: 2018-01-08

External identifier of this OGC® document: <http://www.openis.net/doc/SHv-features/1.0>

Internal reference number of this OGC® document: 14-11116

Version: 1.0

Category: OGC® Implementation Standard

Editor: David Bloodgett, Irina Dornhuber

OGC® WaterML 2: Part 3 - Surface Hydrology Features (HY_Features) - Conceptual Model

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Document type: OGC® Standard

Document subtype:

Document stage: Approved

Document language: English

Open Geospatial Consortium

Submission Date: 2021-11-18

Approval Date: 2022-03-07

Publication Date: 2023-05-26

External identifier of this OGC® document: <http://www.openis.net/doc/asom/3.0>

Internal reference number of this OGC® document: 20-082r4

Version: 3.0.0

Category: OGC® Abstract Specification

Editors: Katharina Schleidt, Ilkka Rinne

OGC Abstract Specification Topic 20: Observations, measurements and samples

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Document type: OGC® Abstract Specification

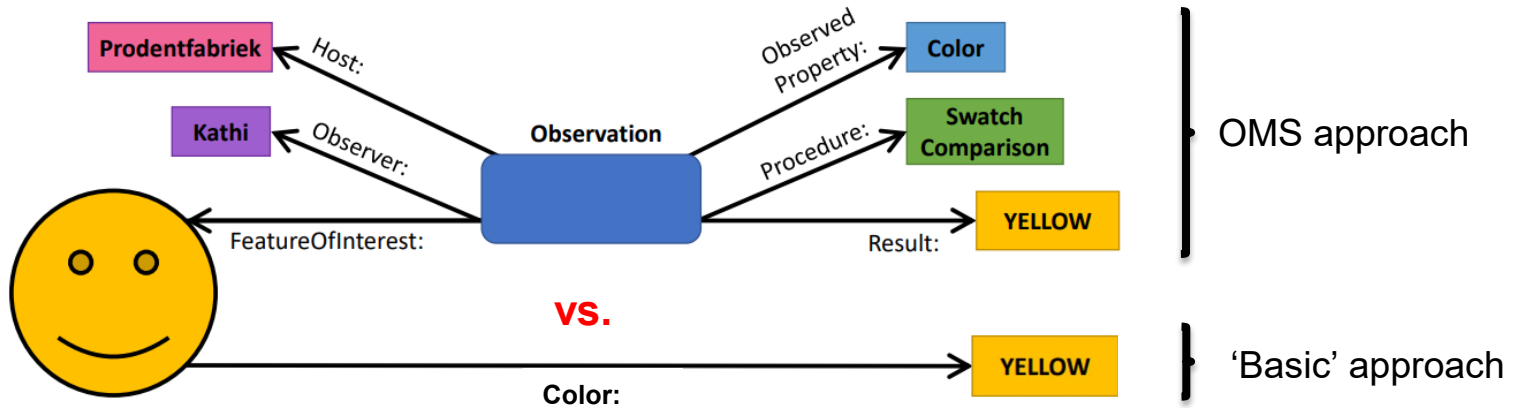
Document subtype:

Document stage: Approved for public release

Document language: English

Conceptual Modelling

- Backbone to build on: OGC/ISO 19156 (2023) : Observations, measurements and samples (a.k.a OMS)

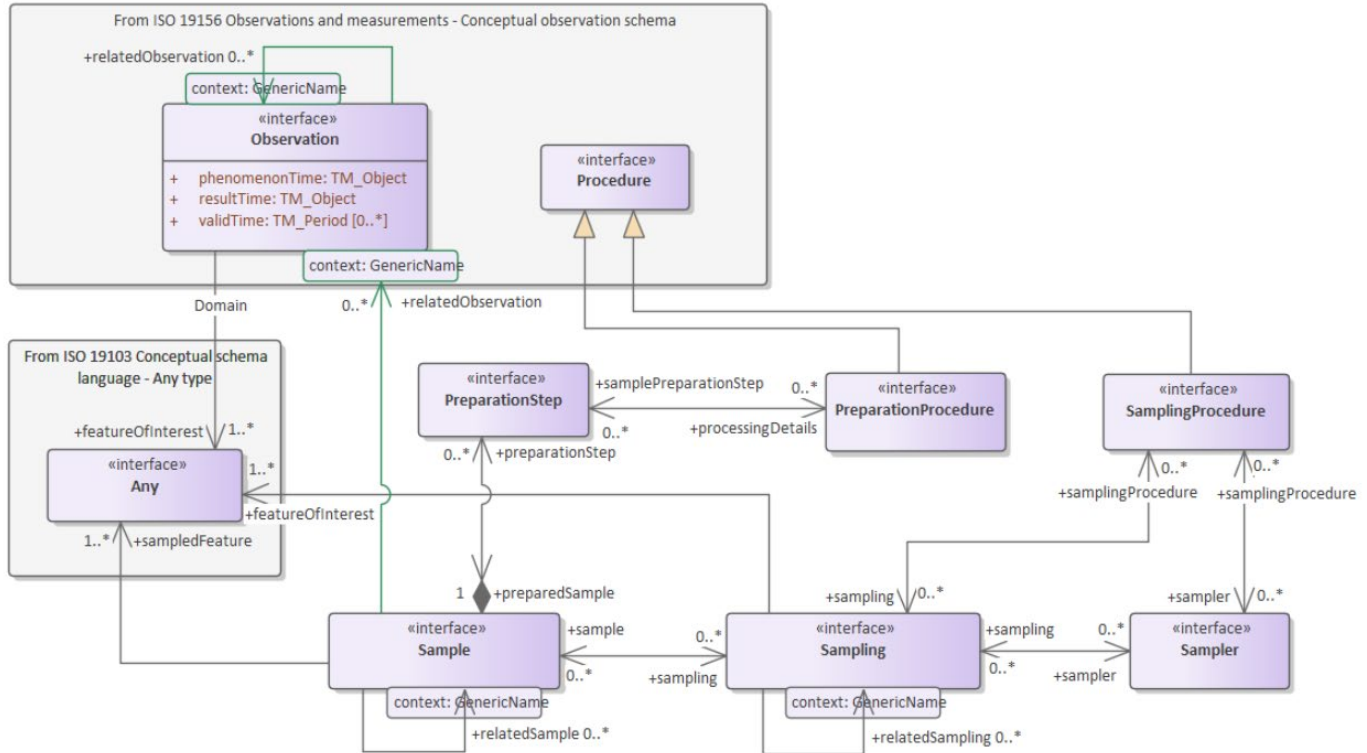


Credits: Kathi Schleidt, DataCove

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

Conceptual Modelling

- Backbone to build on: Observations, measurements and samples



Conceptual Modelling

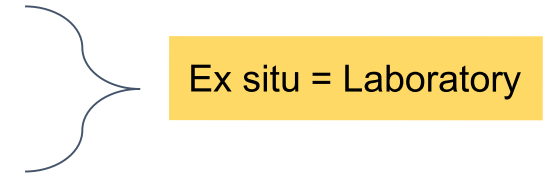
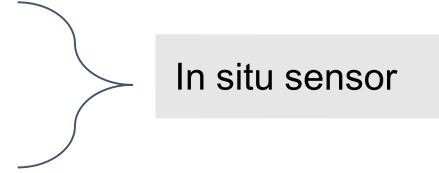
- Work organised around the identified UseCases
- Everything available online : <https://umltool.ogc.org/login.php>
 - Follow this path /OGC IEs/ WaterQuality_IE/ WaterQuality_Instance
- Ground Water (GW)
 - GW_InSitu_QuantityObservation
 - GW_InSitu_QualityObservation
 - GW_ExSitu_QualityObservation
- Surface Water (SW)
 - SW_InSitu_QuantityObservation
 - SW_InSitu_QualityObservation
 - SW_ExSitu_QualityObservation





Conceptual Modelling

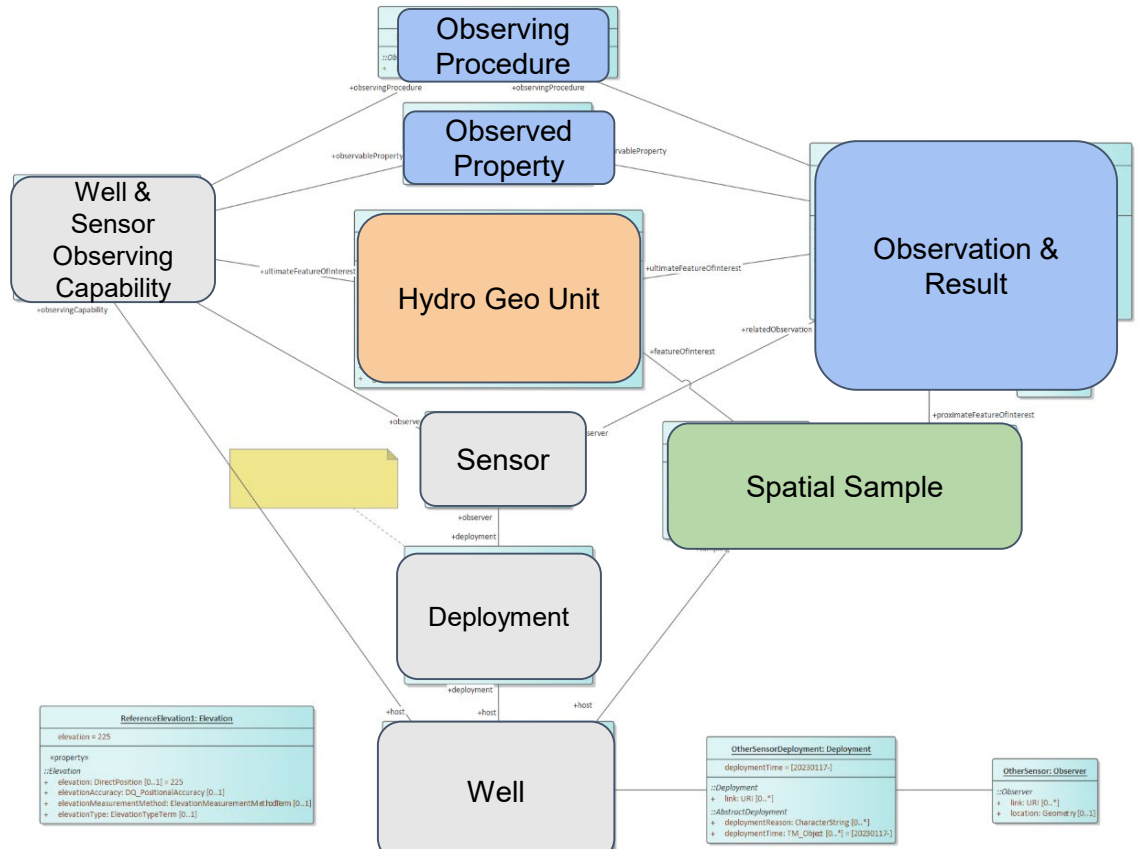
- 2 modelling patterns
- GW_InSitu_QuantityObservation <> SW_InSitu_QuantityObservation
GW_InSitu_QualityObservation <> SW_InSitu_QualityObservation
- GW_ExSitu_QualityObservation <> SW_ExSitu_QualityObservation



In situ sensor

Conceptual Modelling

- GW_InSitu_QuantityObservation (water level)



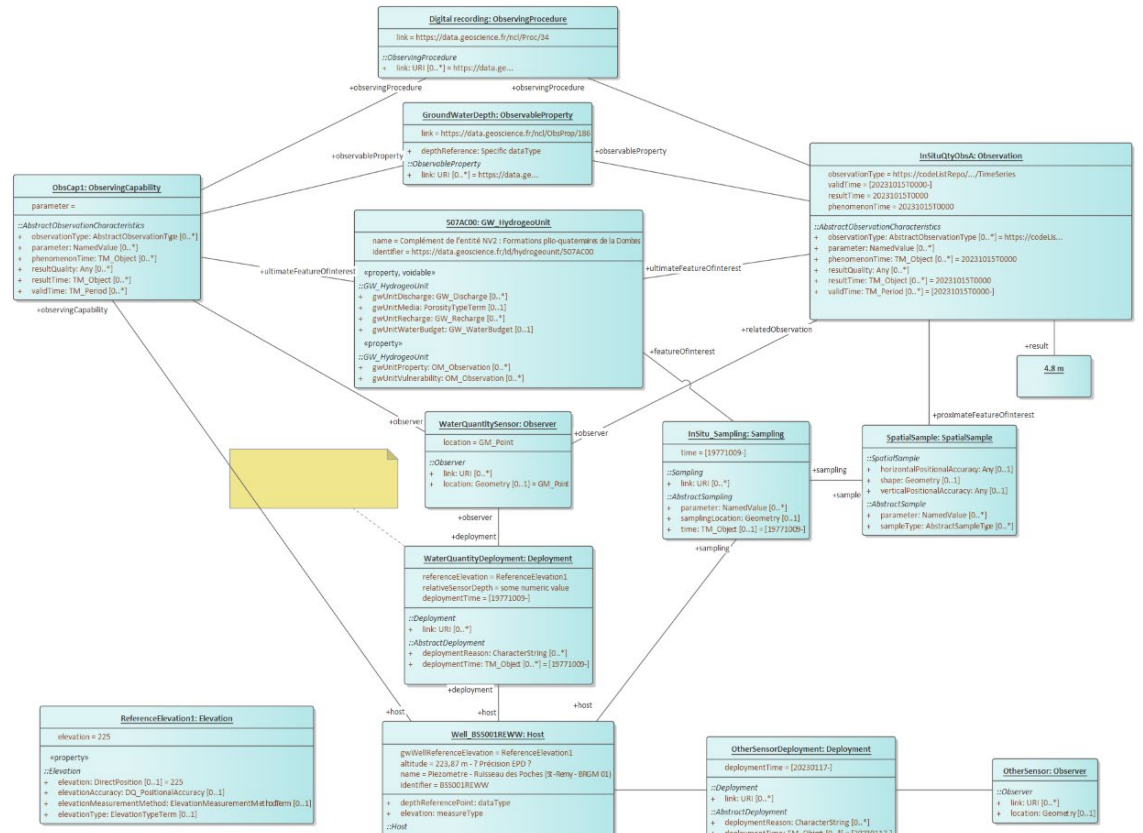
```
ReferenceElevation: Elevation
elevation = 225
+property
::Elevation
+ elevation: DirectPosition [0..1] = 225
+ elevationAccuracy: DO_PositionalAccuracy [0..1]
+ elevationMeasurementMethod: ElevationMeasurementMethodTerm [0..1]
+ elevationType: ElevationTypeTerm [0..1]
```

```
OtherSensorDeployment: Deployment
deploymentTime = [2020117]
+deployment
+ link: URI [0..*]
::AbstractDeployment
+ deploymentReason: CharacterString [0..1]
+ deploymentTime: TM_Object [0..1] = [2020117]
```

```
OtherSensor: Observer
+ Observer
+ link: URI [0..1]
+ location: Geometry [0..1]
```


Conceptual Modelling

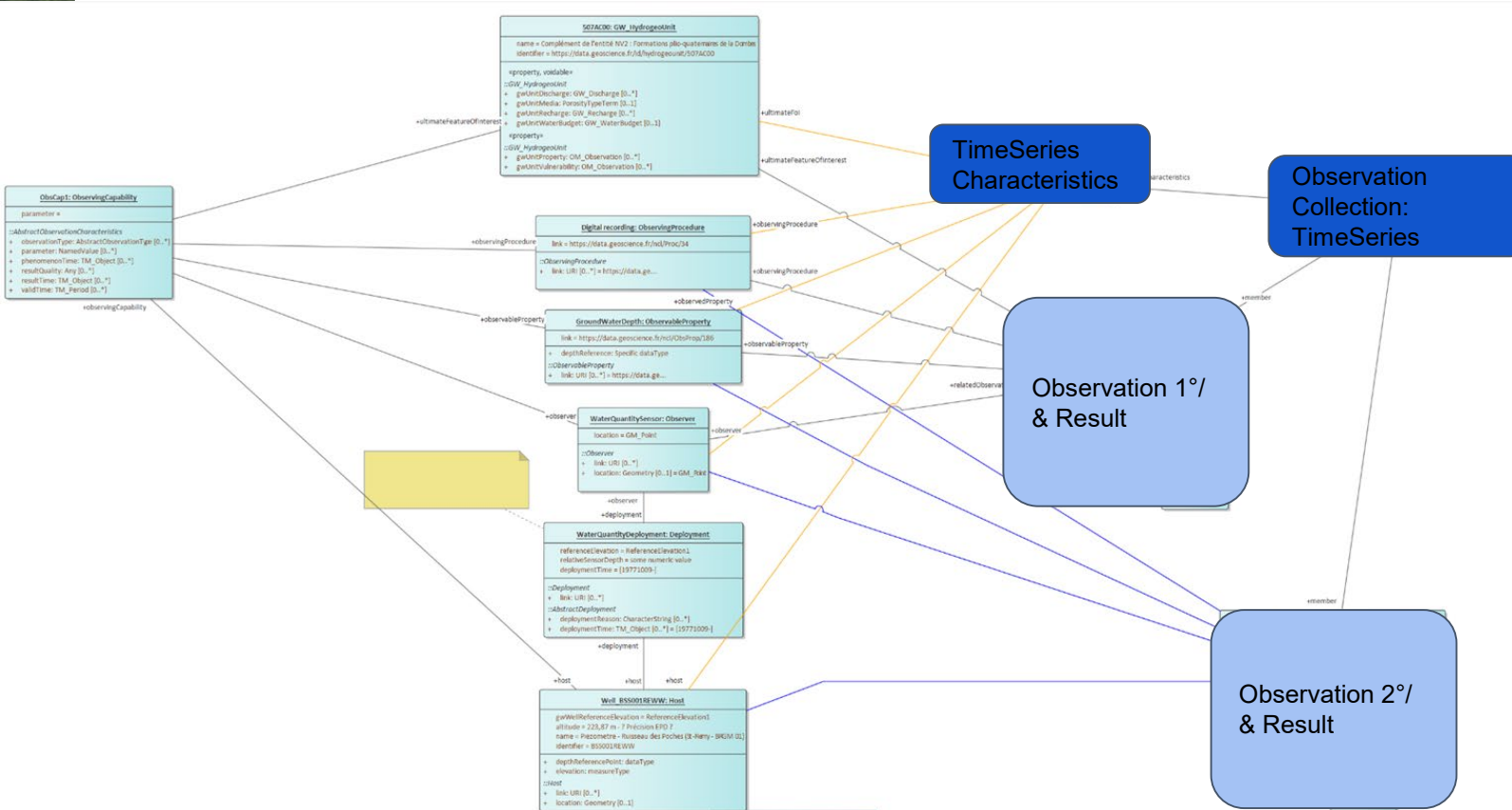
- GW_InSitu_QuantityObservation (water level)



In situ sensor

Conceptual Modelling

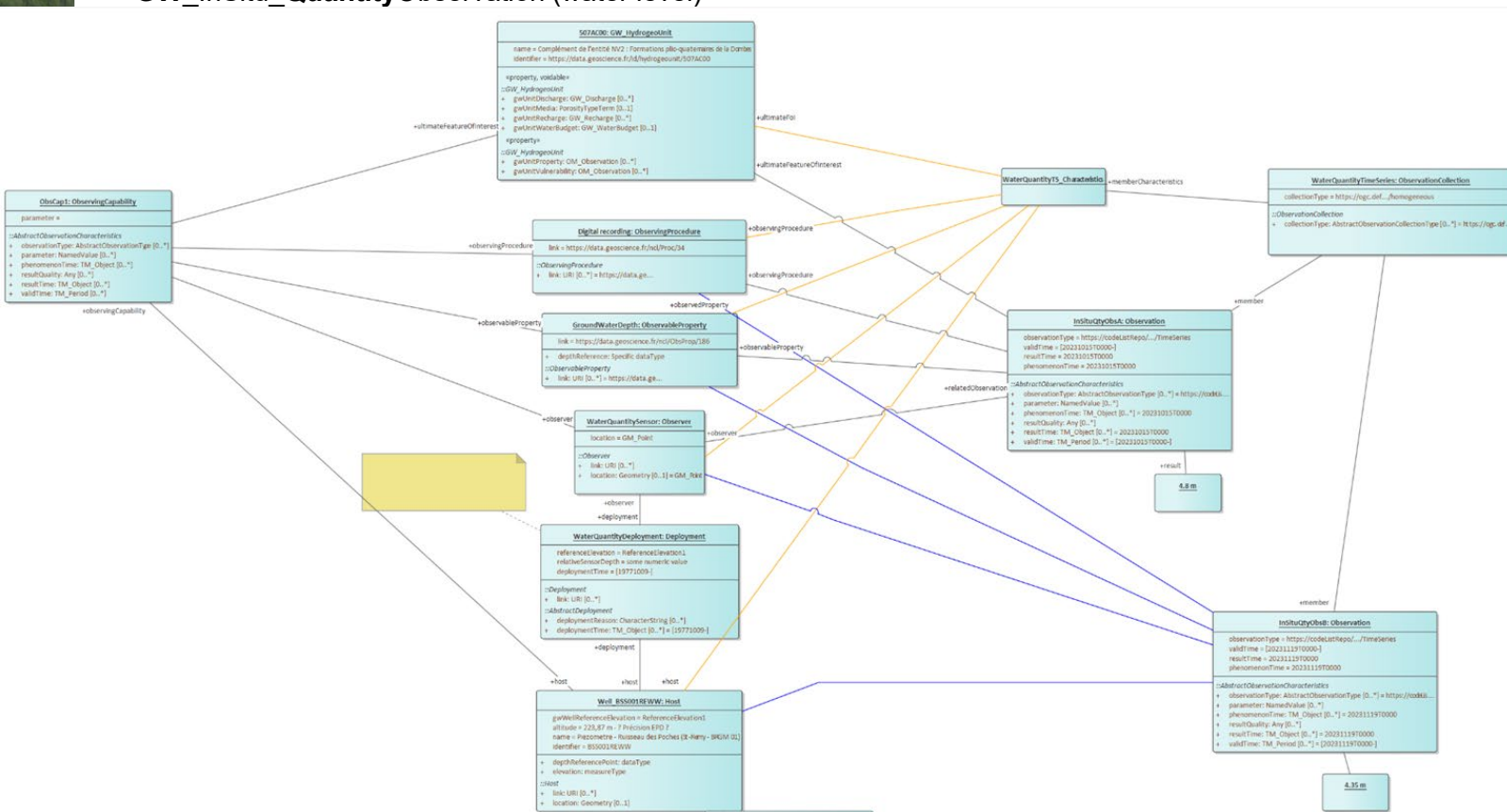
- **GW_InSitu_QuantityObservation** (water level)



Conceptual Modelling

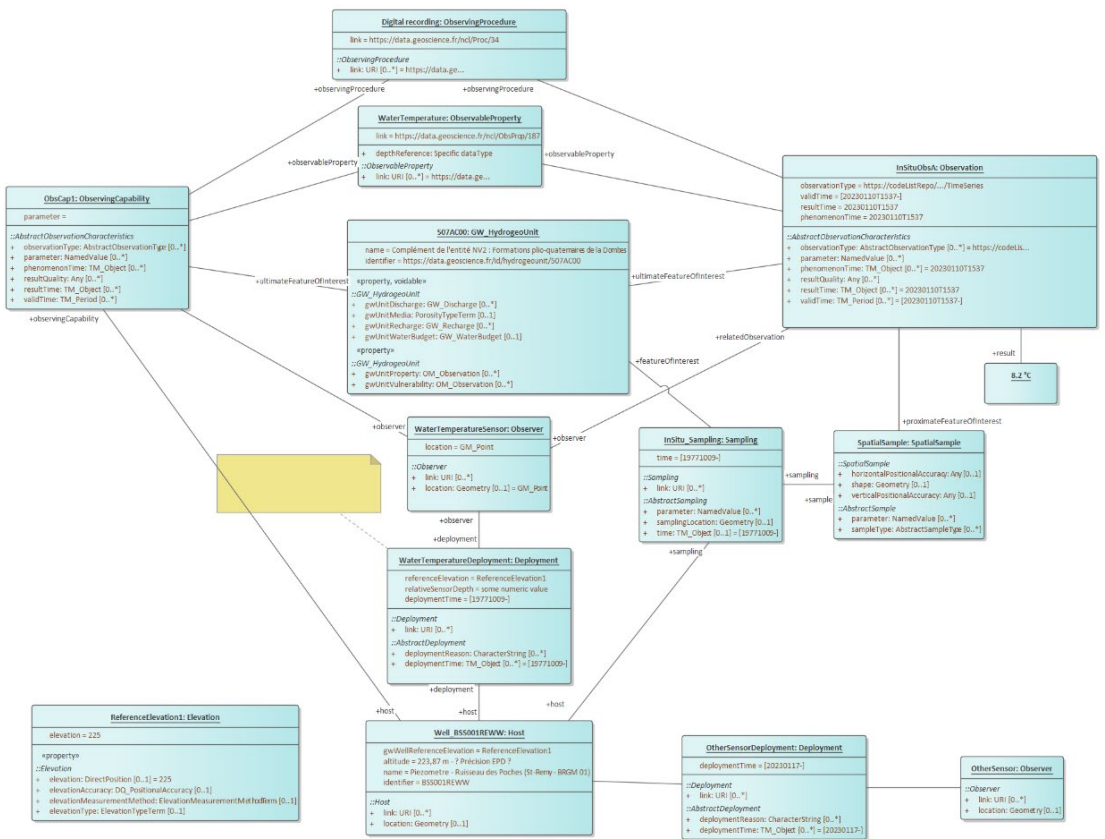
In situ sensor

- GW_InSitu_QuantityObservation (water level)



Conceptual Modelling

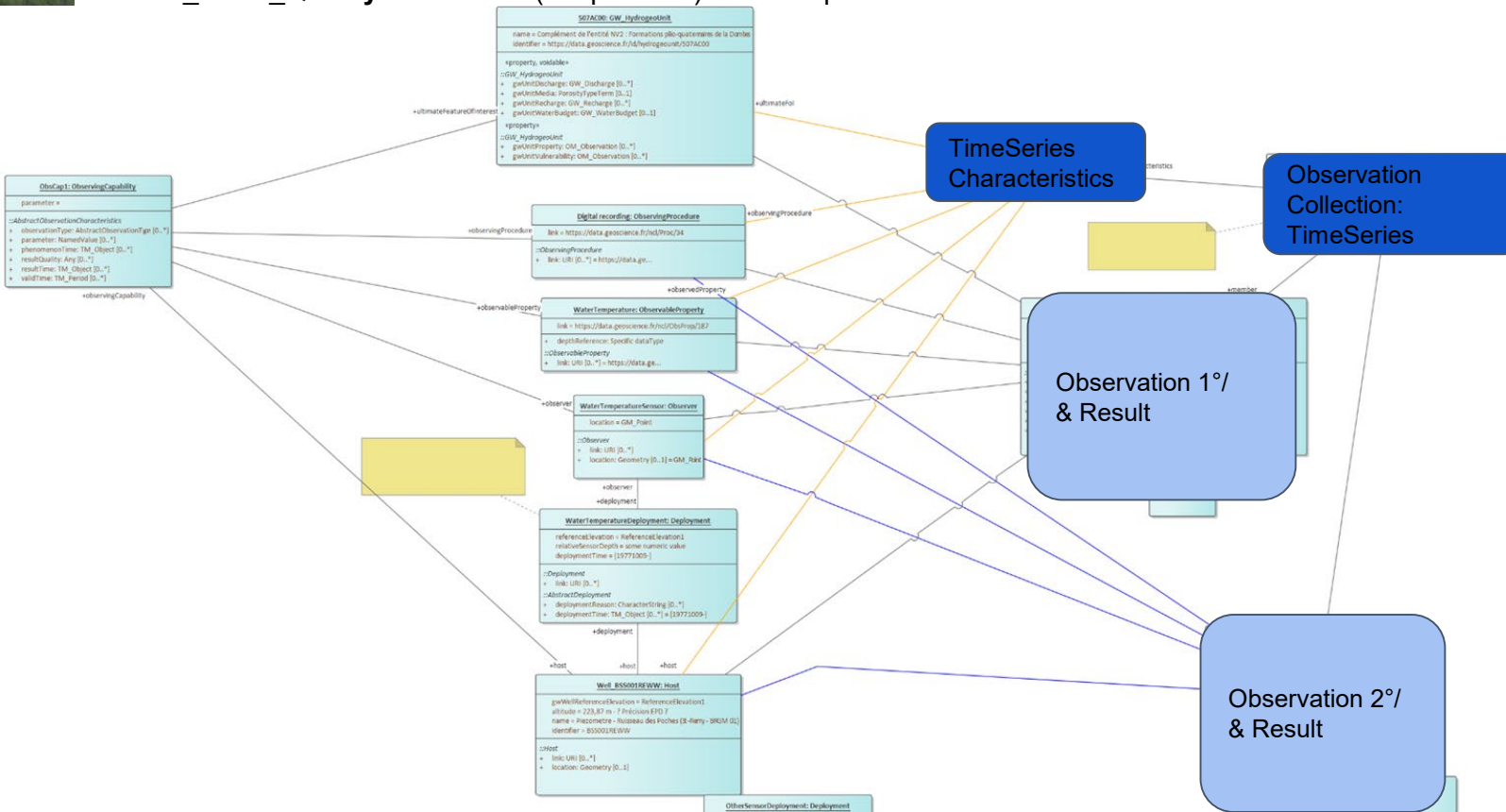
- GW_InSitu_QualityObservation (temperature) => same pattern



In situ sensor

Conceptual Modelling

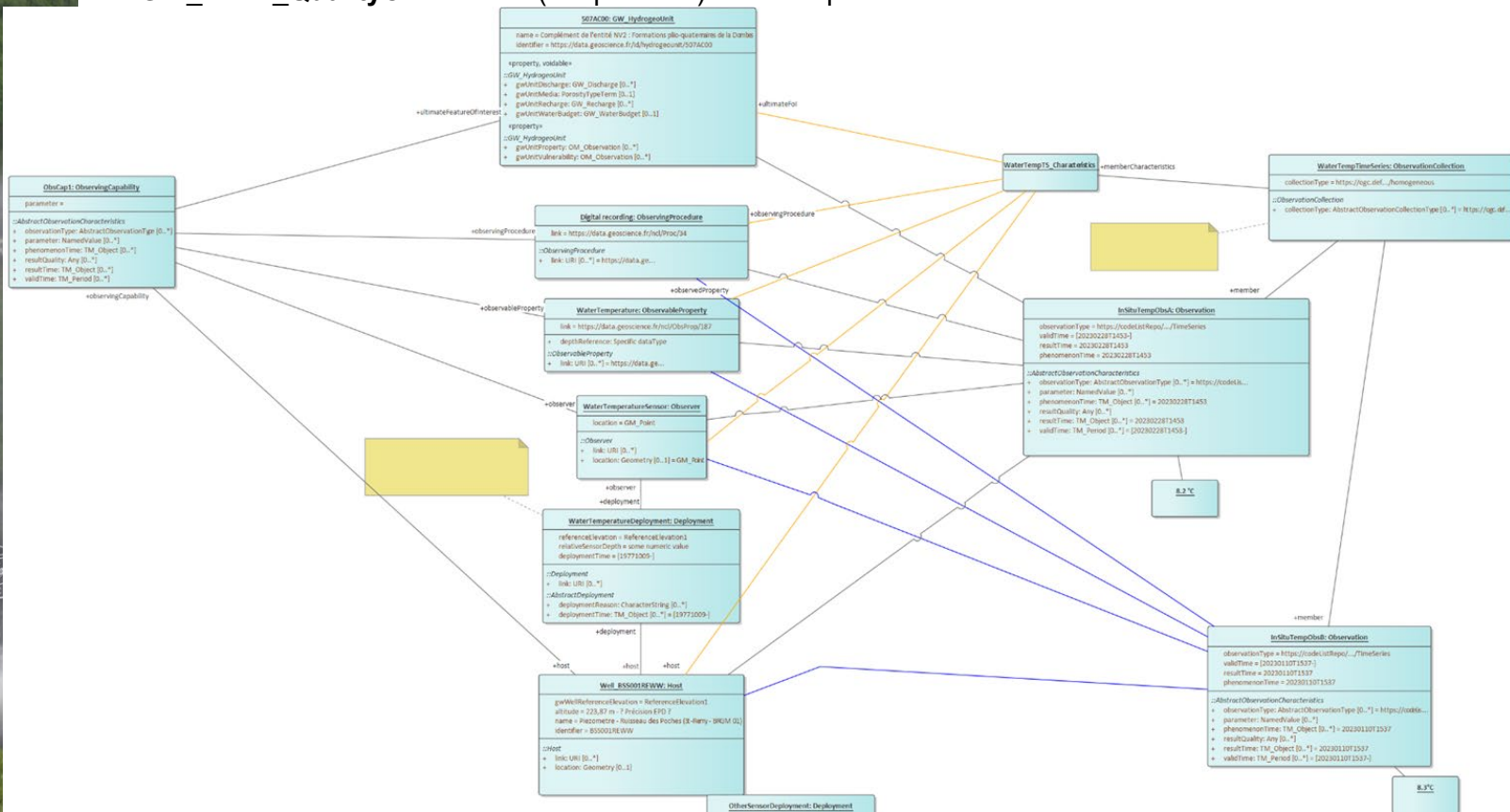
- **GW_InSitu_QualityObservation (temperature)** => same pattern



Conceptual Modelling

In situ sensor

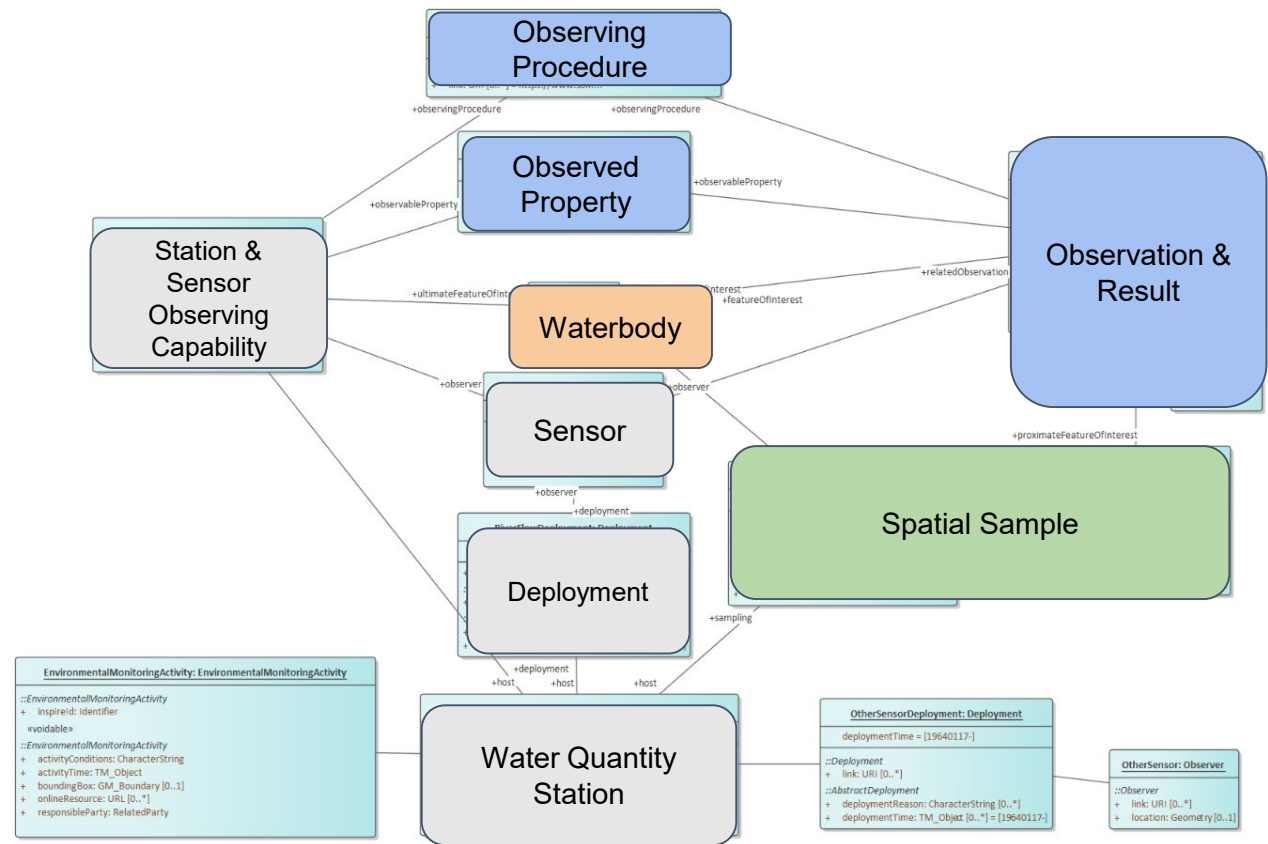
- GW_InSitu_QualityObservation (temperature) => same pattern



In situ sensor

Conceptual Modelling

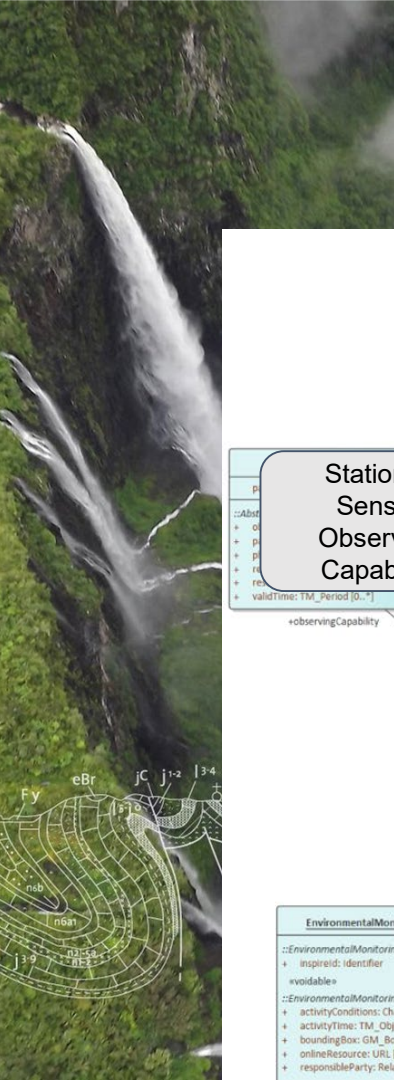
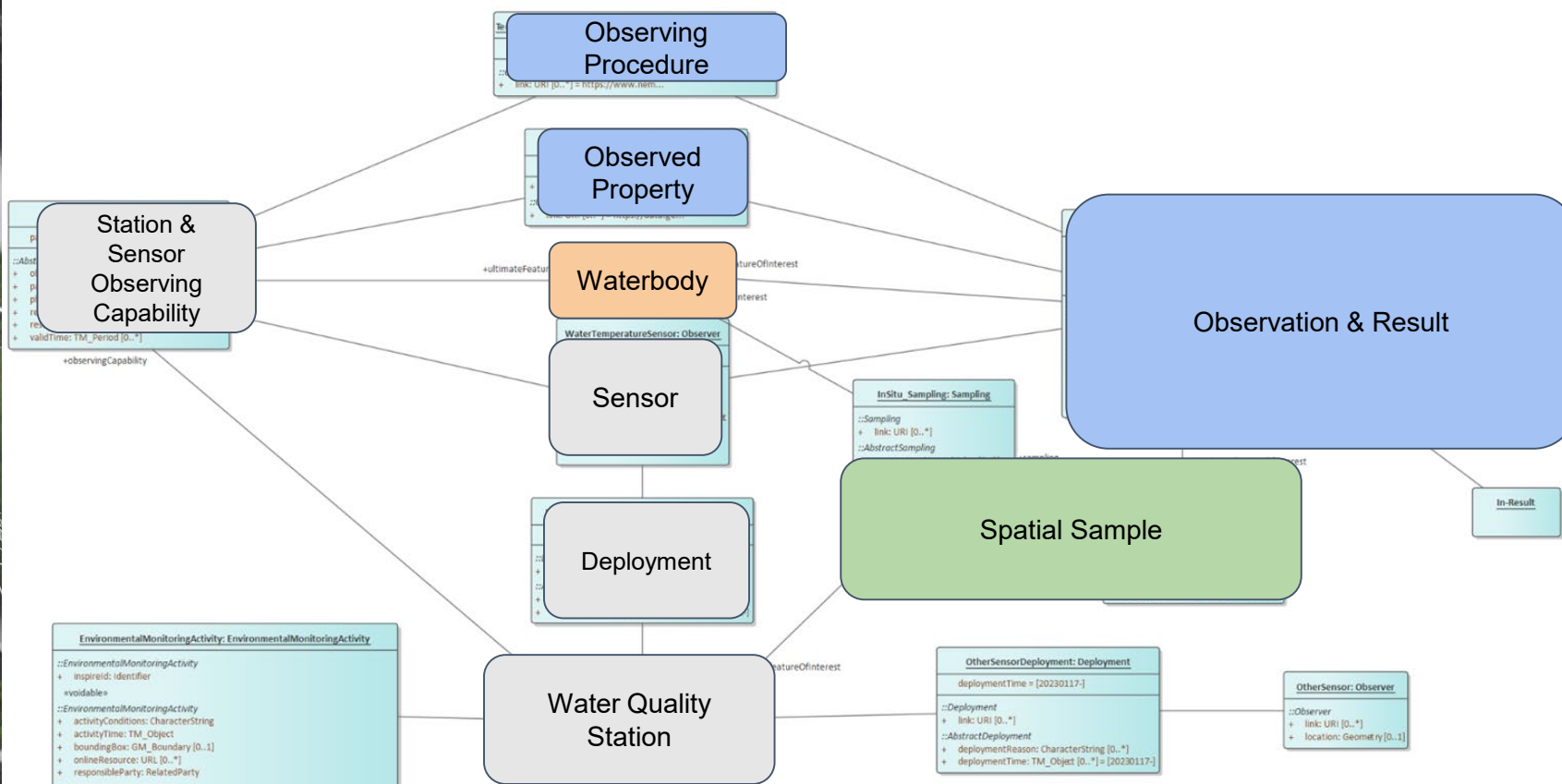
- SW_InSitu_QuantityObservation (river flow) => same pattern



In situ sensor

Conceptual Modelling

- SW_InSitu_QualityObservation (temperature, pH) => same pattern

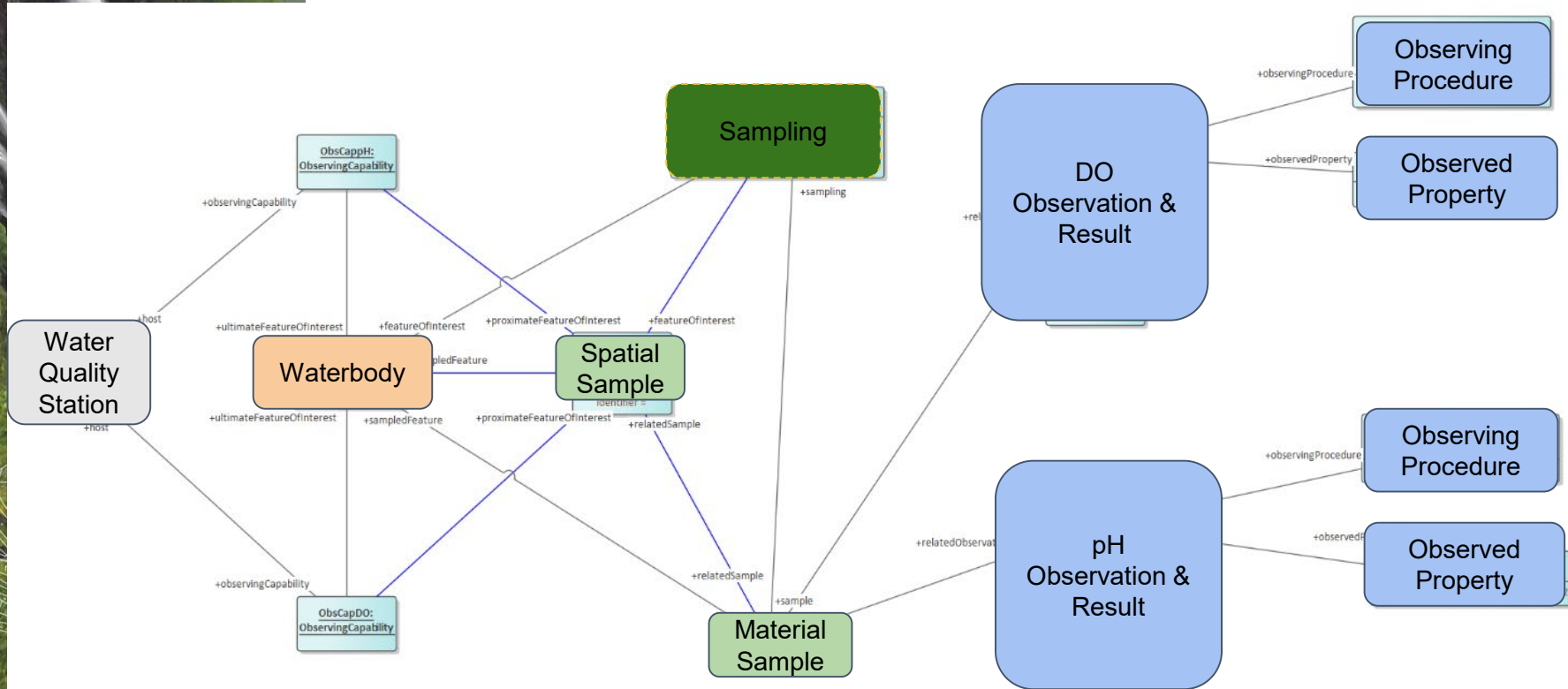




Conceptual Modelling

Ex situ = Lab

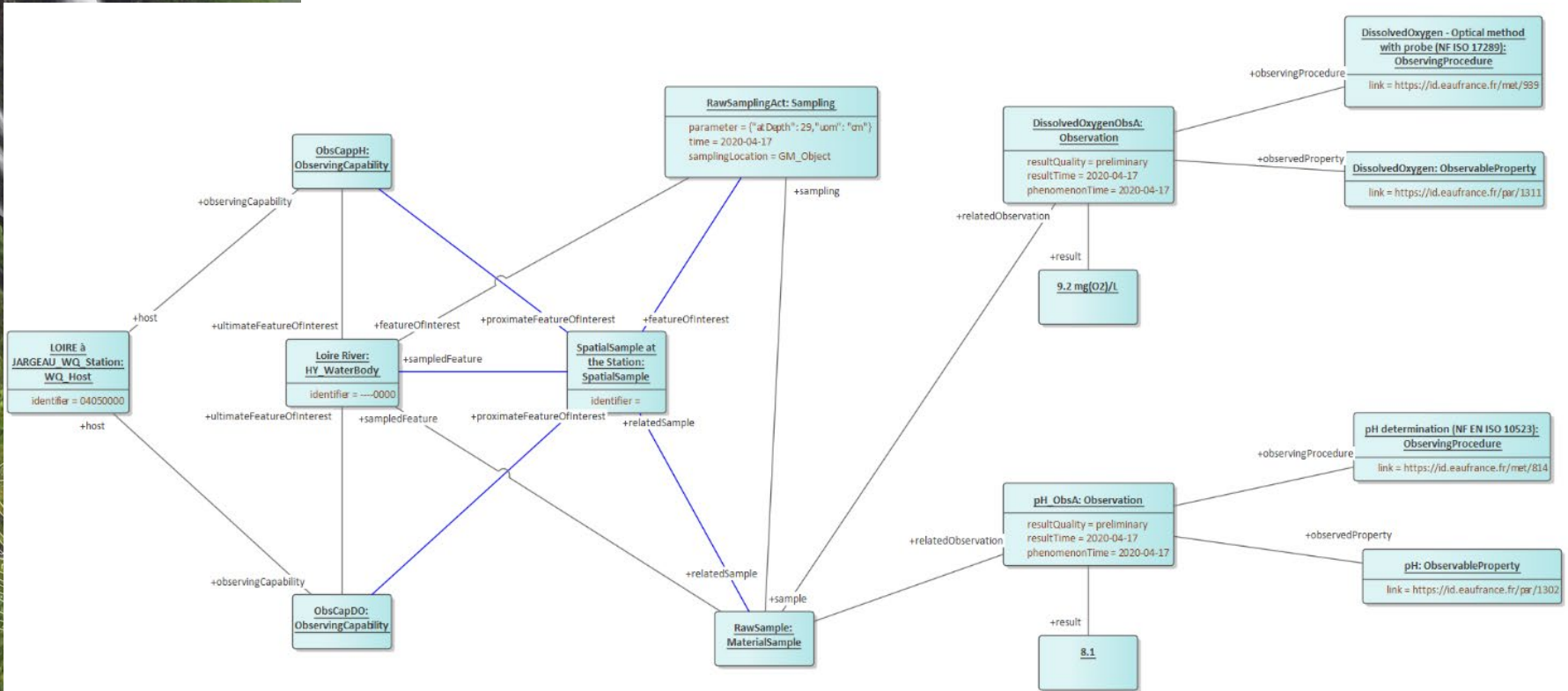
- SW_ExSitu_QualityObservation (ex : Dissolved Oxygen, pH)



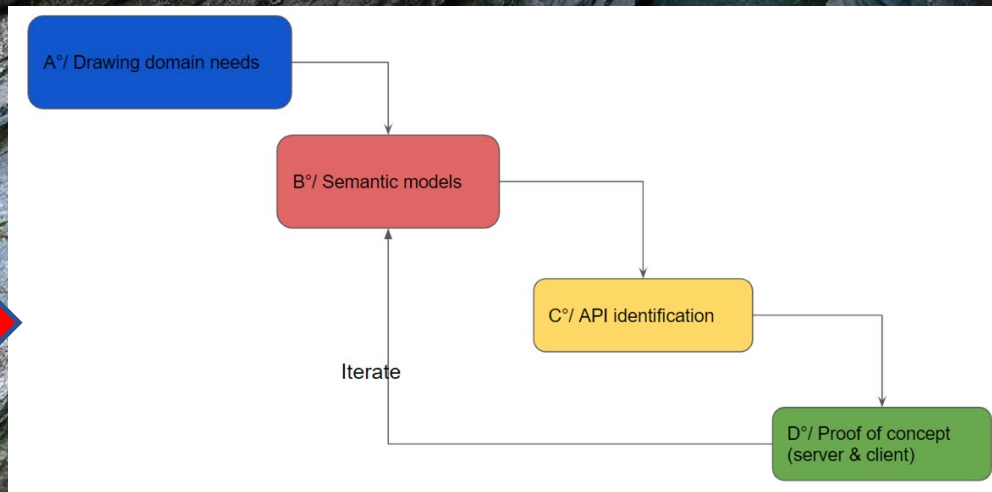
Conceptual Modelling

Ex situ = Lab

- SW_ExSitu_QualityObservation (ex : Dissolved Oxygen, pH)



FAIR water quality data exchange thanks to international OGC water standards





Which interoperable / FAIR API ?

Available options

1. OGC WFS/API Features :

- All the identified concepts are Features => could work
- Not tied to a specific semantic/model and quite limited query mechanism on Observation topics

2. OGC SensorThings API

- Semantics : Already Observations & Measurements compliant
- Powerful query mechanism based on OASIS oData

Decision

1. Use OGC SensorThings API for Observation, Samples sharing and also a bit of River, Aquifer, Well information => core of the implementation, work presented here
2. Use OGC WFS / API – Features for pure geospatial features description / Use Cases : River, Aquifer, Well etc...

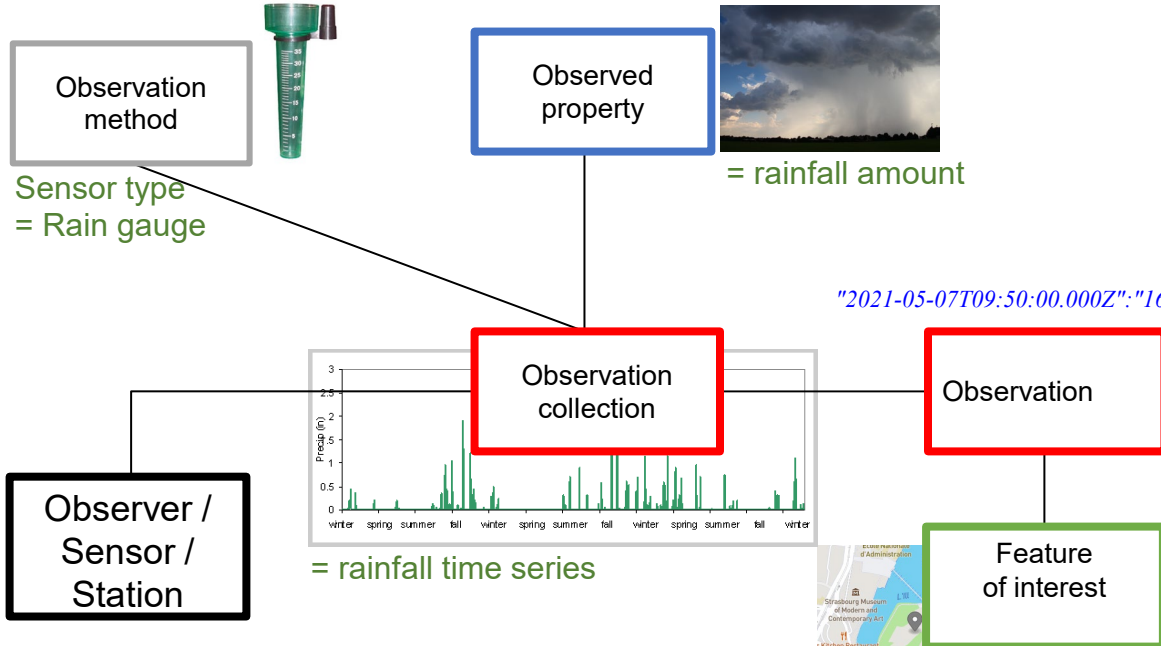


OGC SensorThings API?

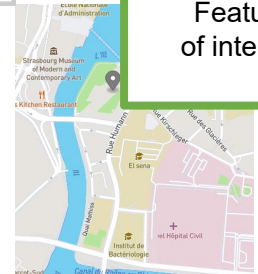
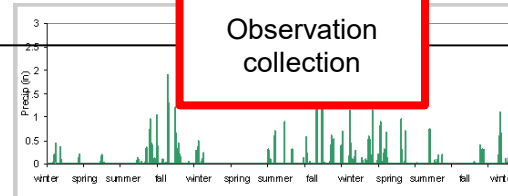
- An OGC standard for exchanging sensor data and metadata
 - Historic data & current data
 - JSON Encoded
 - RESTful
 - Adapting OASIS OData URL patterns and query options
 - Supporting ISO MQTT messaging
- Easy to use & understandable
 - Discoverable with only a web browser

OGC SensorThings API?

Layman's terms



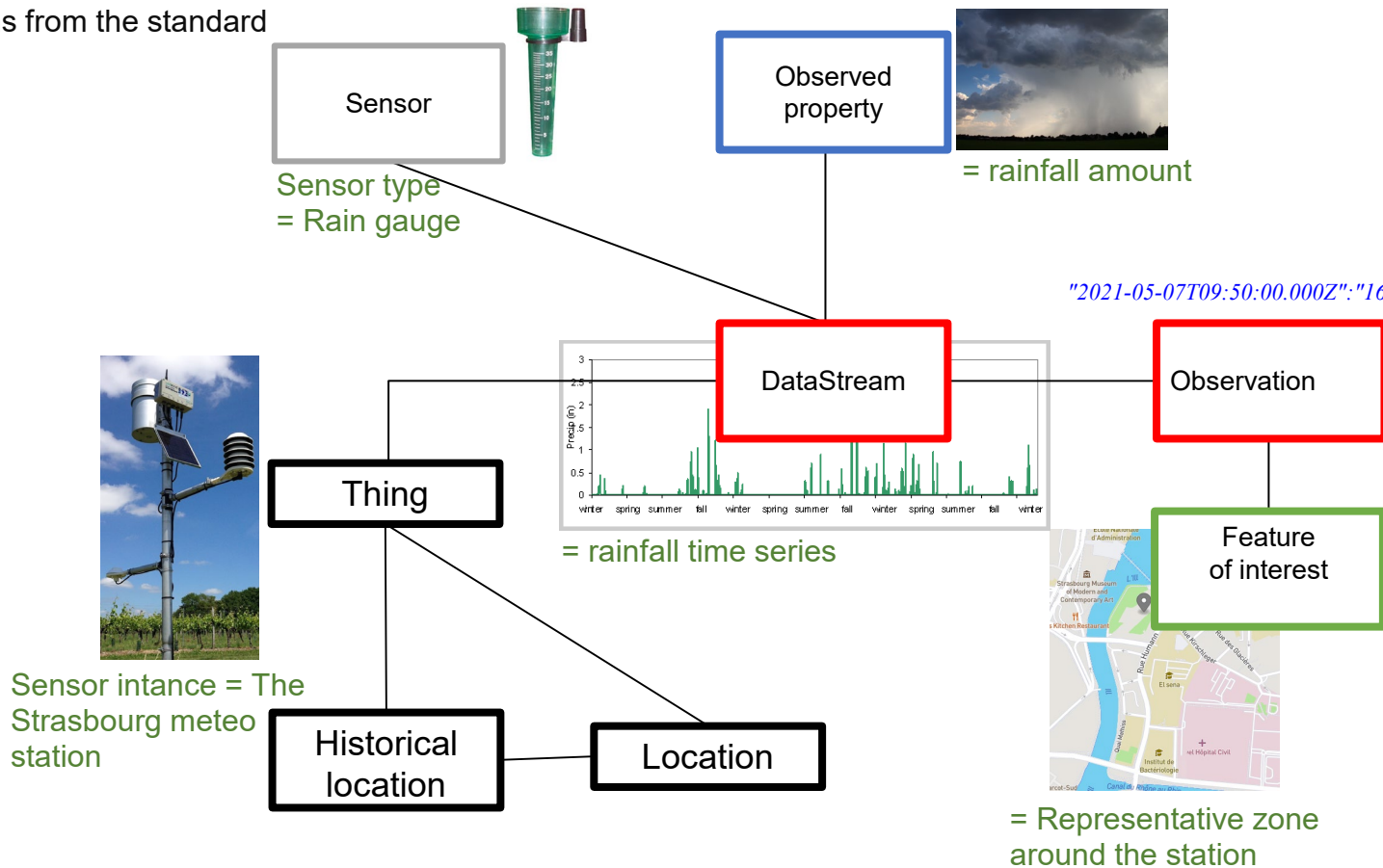
Sensor instance = The
Strasbourg meteo
station



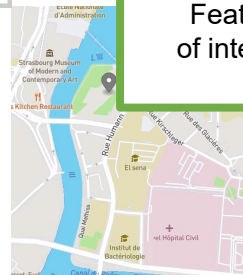
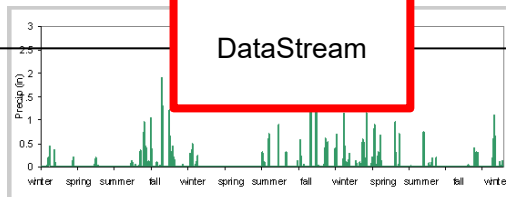
= Representative zone
around the station

OGC SensorThings API?

Terms from the standard

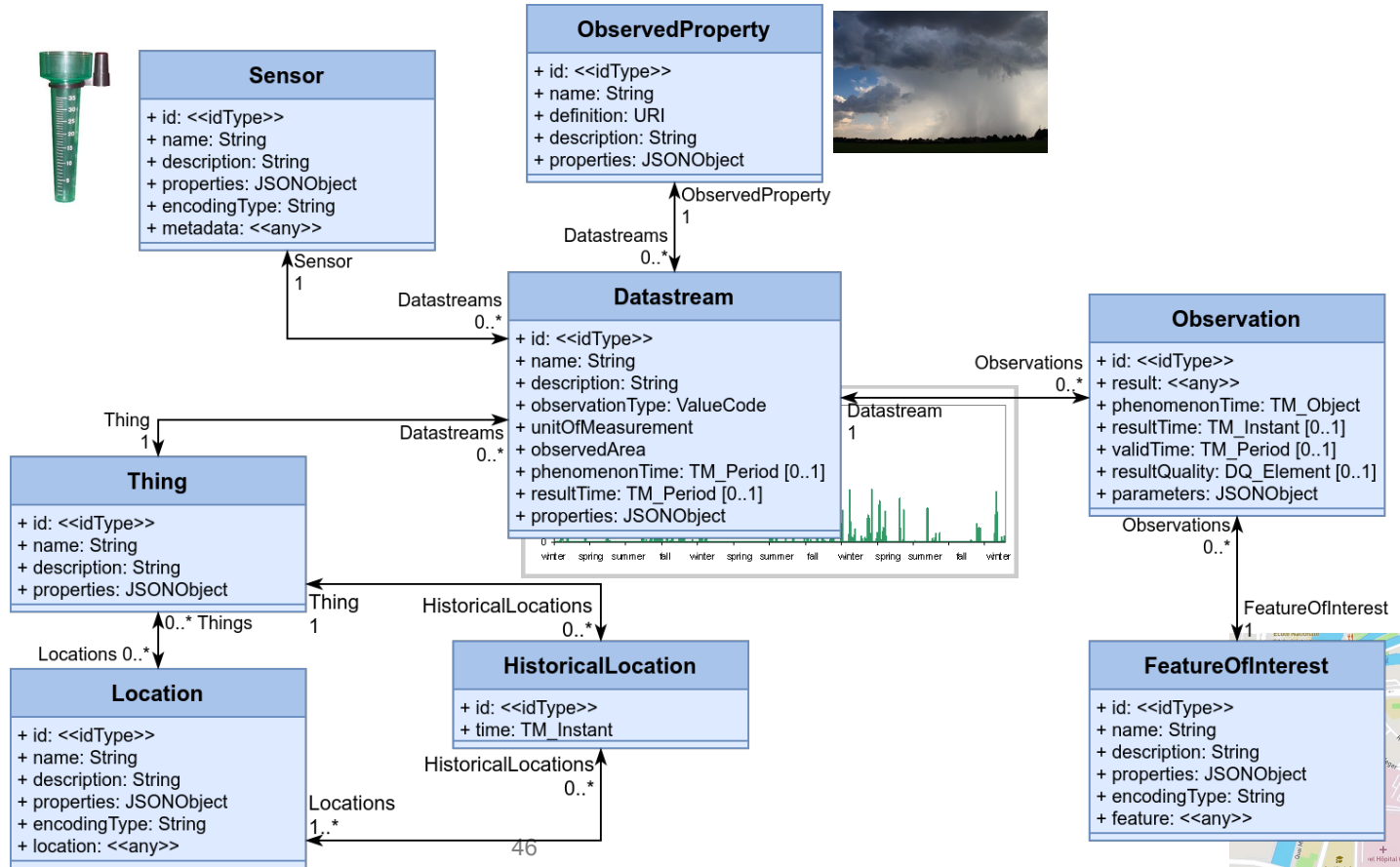


Sensor instance = The
Strasbourg meteo
station



= Representative zone
around the station

SensorThings API 1.1 – Data Model



SensorThings live demo

- <https://airquality-frost.k8s.ilt-dmz.iosb.fraunhofer.de/v1.1>
 - ~760 000 000 Observations
 - ~21 000 Datastreams
 - ~5 000 Stations
- Docker Quick-Start:
<https://fraunhoferiosb.github.io/FROST-Server/deployment/docker.html>
- Full SensorThings API Tutorial
https://fraunhoferiosb.github.io/FROST-Server/sensorthingsapi/1_Home.html

SensorThings API 1.1 – API

HTTP:

	GET	POST	PATCH	DELETE
v1.1	Get index			
v1.1/Type	Get all of type	Create		
v1.1/Type(id)	Get one of type		Update	Delete
v1.1/Type(id)/Entity	Get linked entity			
v1.1/Type(id)/EntitySet	Get all linked	Create Linked		

- Fully Explorable with just a browser
- Composable Responses
- Powerful filtering

MQTT:

1. Subscribe
 - v1.1/Things
 - v1.1/Datastreams(x)
 - v1.1/Datastreams(x)/Observations
 - etc.
2. Get Notified

Fancy Queries

All data for a map:

```
v1.1/Things?
```

```
  $select=id,name,description,properties&  
  $top=10&
```

```
  $filter=properties/countryCode eq 'HR'&  
  $expand=
```

```
    Locations($select=location),
```

```
    Datastreams (
```

```
      $select=id,name,unitOfMeasurement;  
      $expand=
```

```
      ObservedProperty($select=name),
```

```
      Observations (
```

```
        $select=result,phenomenonTime;
```

```
        $orderby=phenomenonTime desc;
```

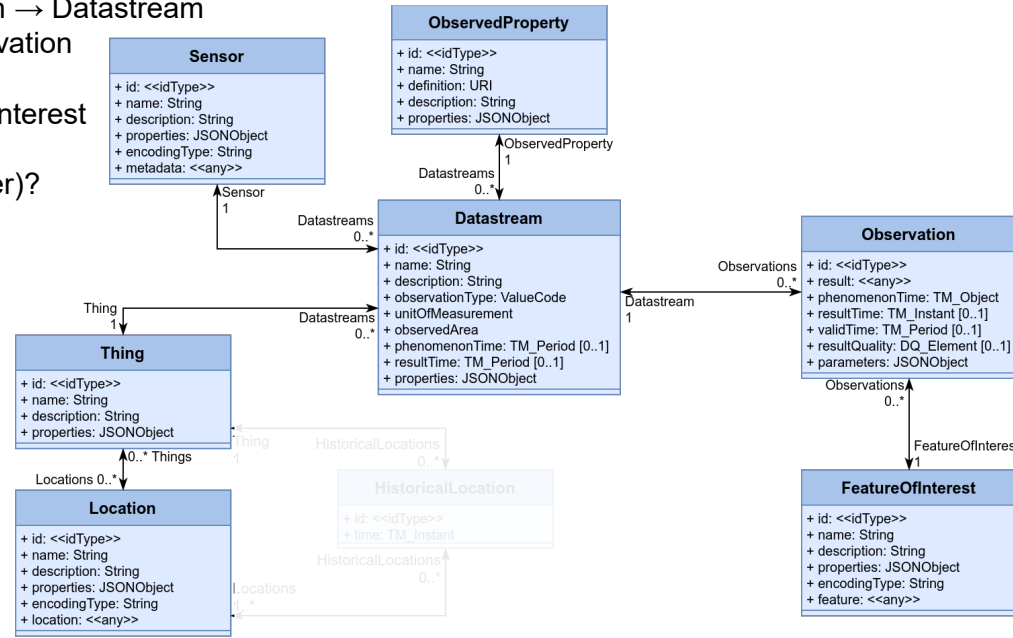
```
        $top=1)
```

```
)
```

[Link](#)

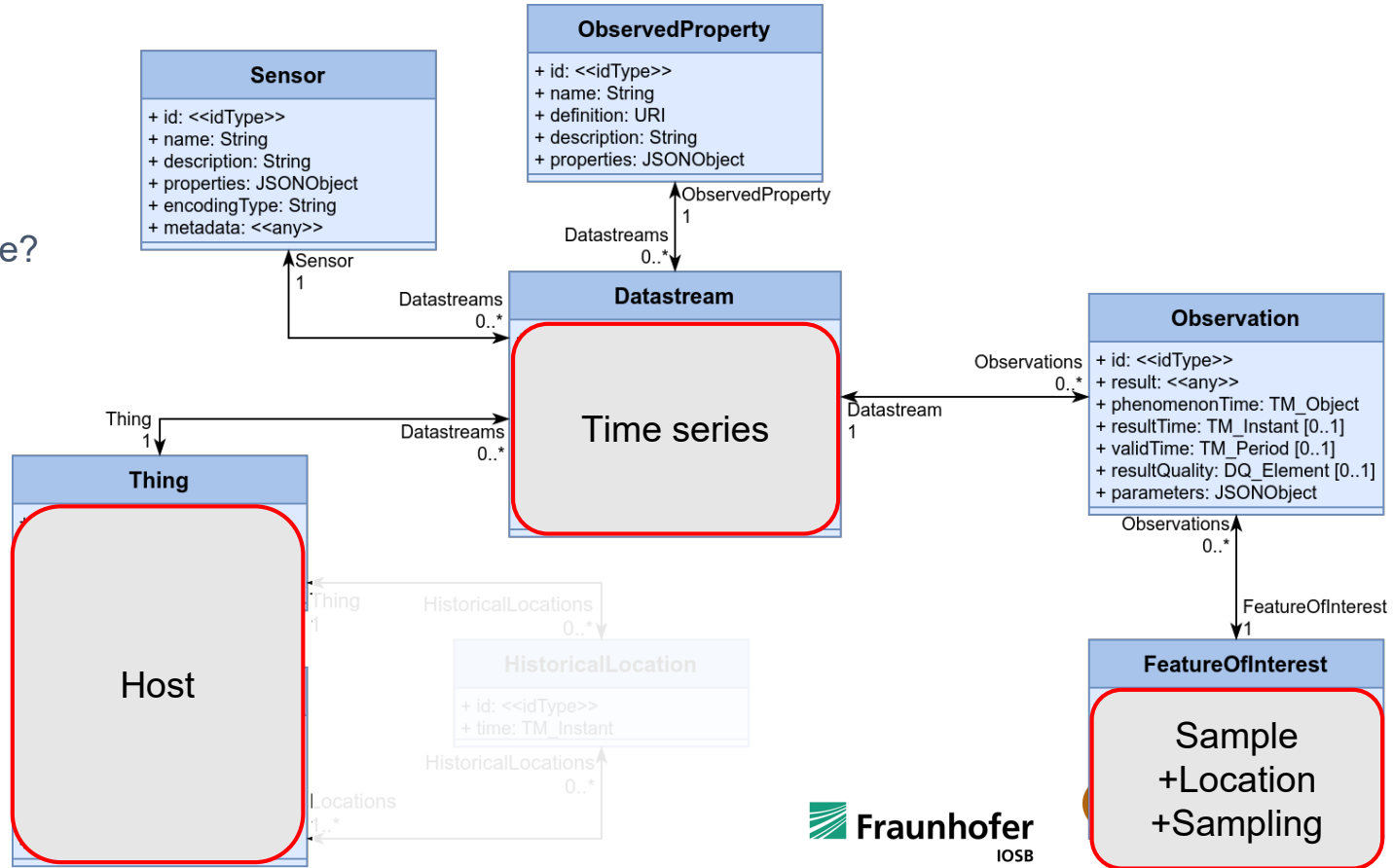
Physical model -> Mapping to OGC SensorThings API

1. Map matching concepts
 - Monitoring Facility → Thing + Location
 - Observed Property → ObservedProperty
 - Observation Collection → Datastream
 - Observation → Observation
 - Observer → Sensor
 - Sample → FeatureOfInterest
2. Add missing Classes
 - SampledFeature (River)?
 - Deployment?
 - Sampler?
 - ObservingProcedure?



SensorThings API 1.1 – Water Quality

- River? (SampledFeature)
- Deployment?
- Sampler?
- ObservingProcedure?

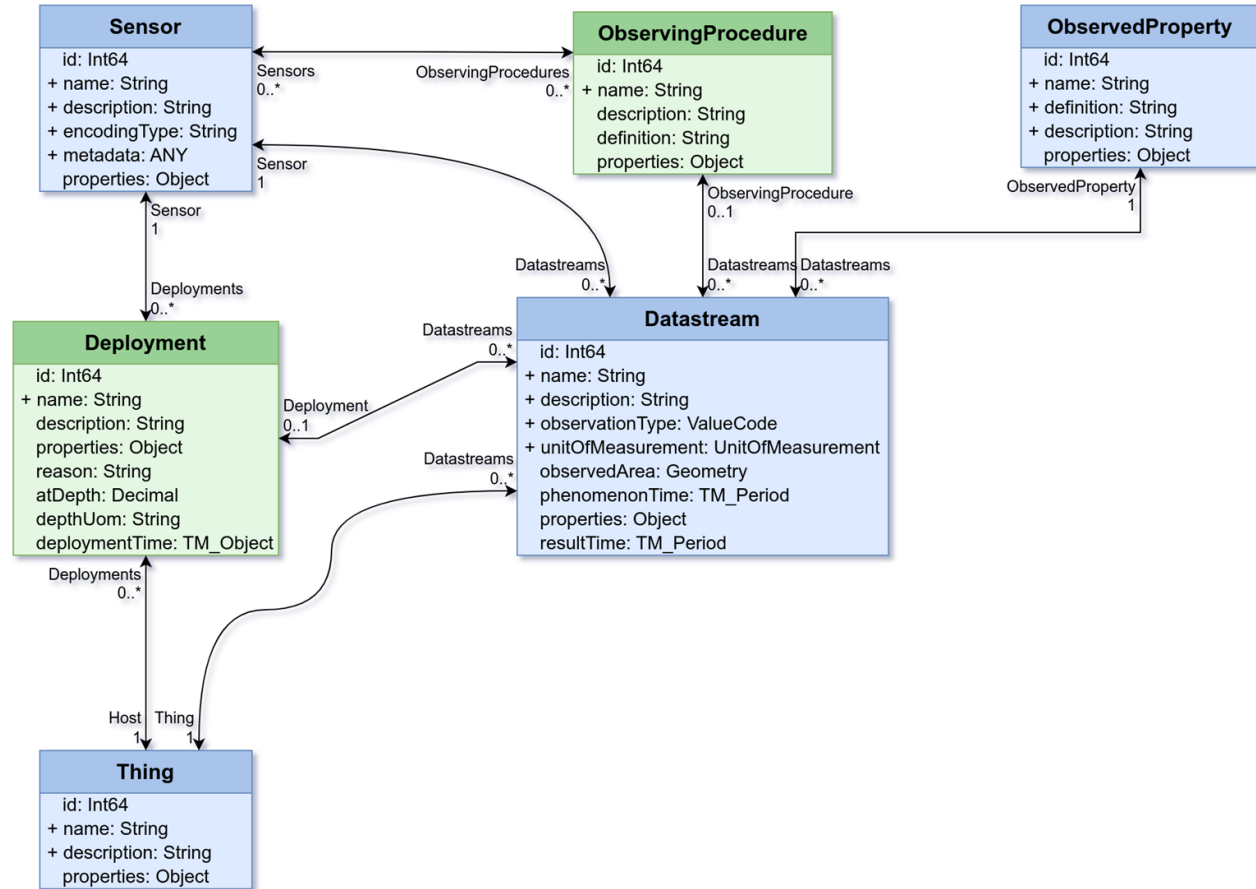


STA 1.1 WQ-IE – Sensor Extensions

Extending the Sensor

- + Deployment
- + ObservingProcedure

OMS
addition

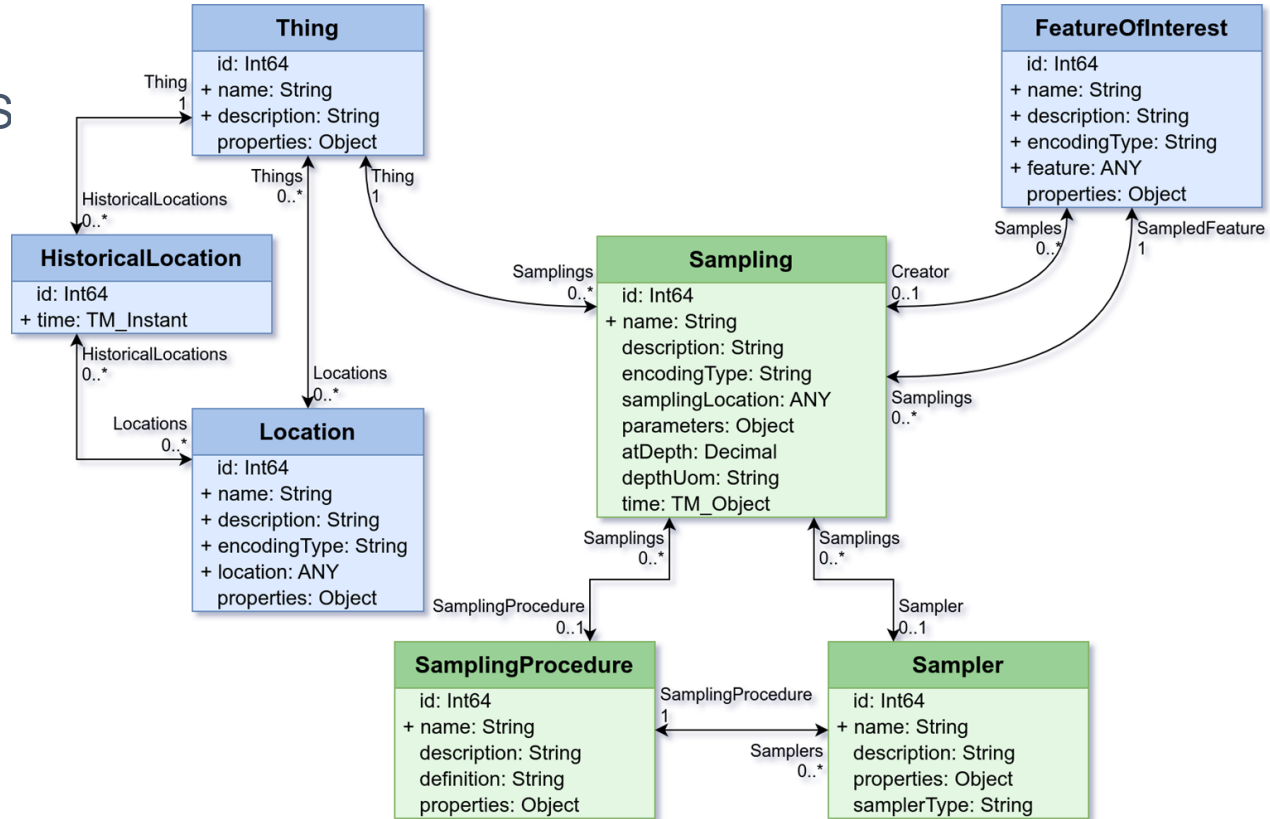


STA 1.1 WQ-IE – Sampling

Adding Sampling from OMS

- + Sampling
- + Sampler
- + SamplingProcedure

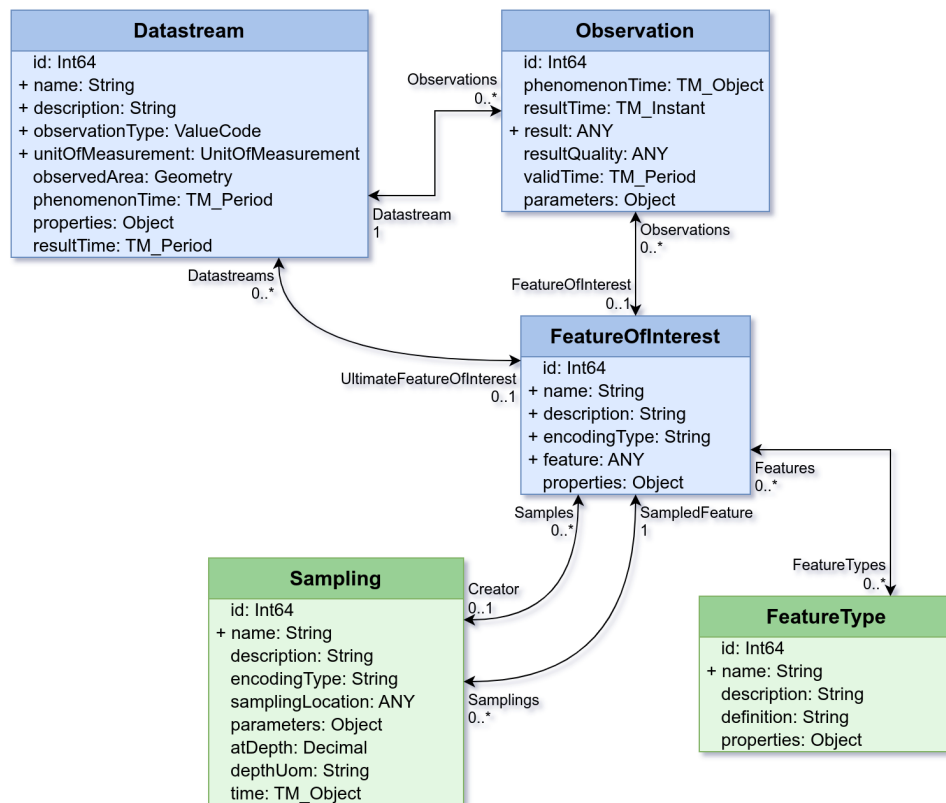
OMS addition



STA 1.1 WQ-IE – Features

Adding the River as Feature and linking a time series

- + FeatureType
- + Datastream → UltimateFeatureOfInterest



OMS addition

STA 1.1 WQ-IE

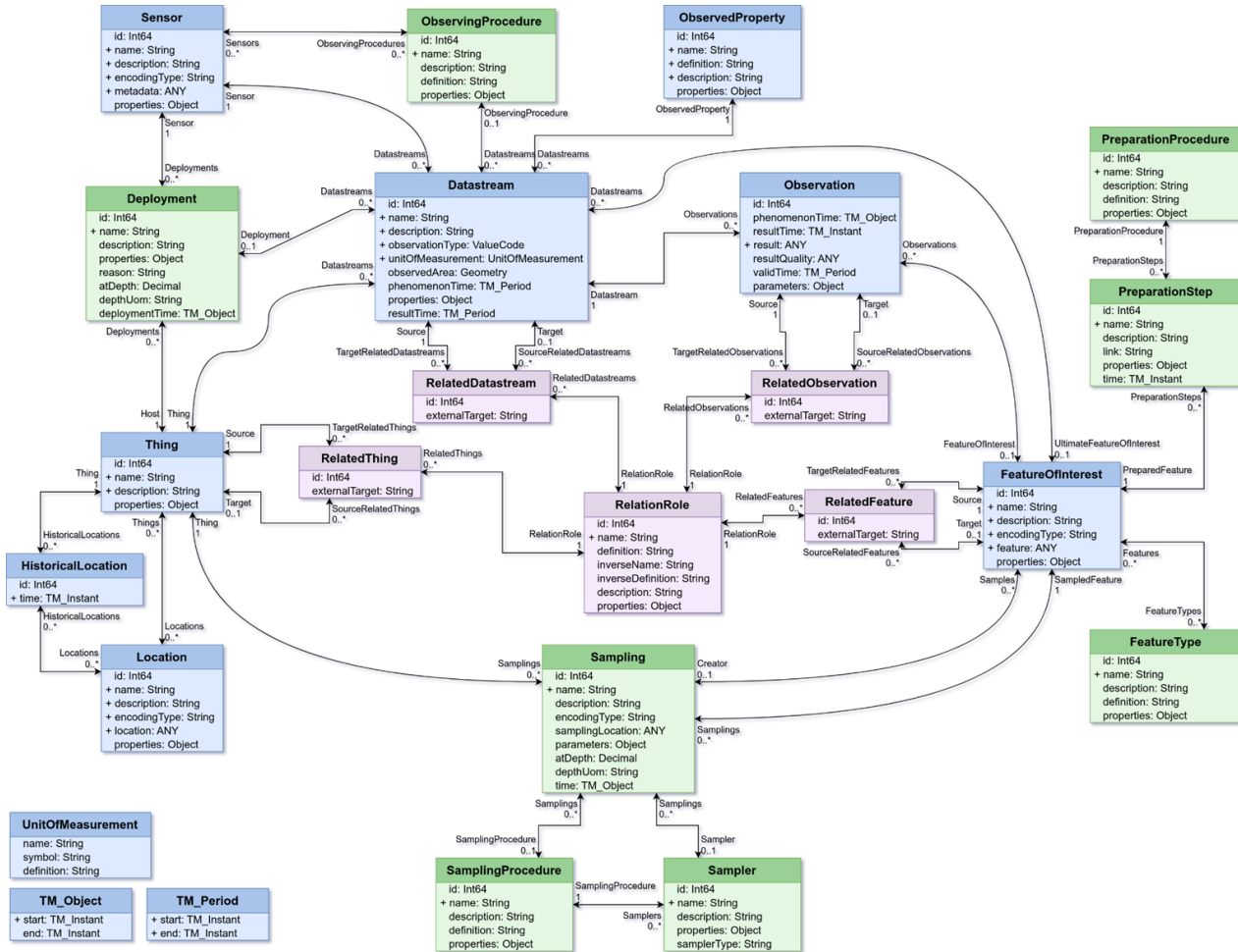
Full data model

- Still v1.1 compatible
- Paving the way to STA 2.0

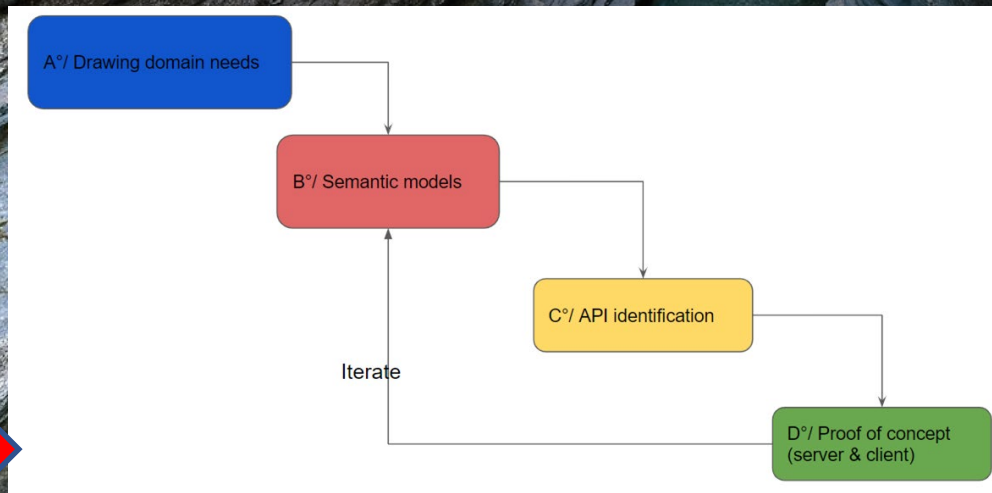
STA 1.1

OMS
addition

Relation
extension



FAIR water quality data exchange thanks to international OGC water standards





Implementation

- Who
 - Water Quality IE members USGS, USEPA, DataStream (Canada), BRGM, BaFG (Unesco Gems water), Fraunhofer
 - EU Water4All project partners
 - Ex : Danish DEP, ISPRA, Fraunhofer, VITO etc...
 - EU GSEU project partners
 - Many EU geological surveys
- What
 - FROST Data Model Plugin <https://github.com/hylkevds/FROST-Server.Plugin.WaterQualityIE>
 - Docker Image <https://hub.docker.com/r/hylkevds/frost-http-waterquality>

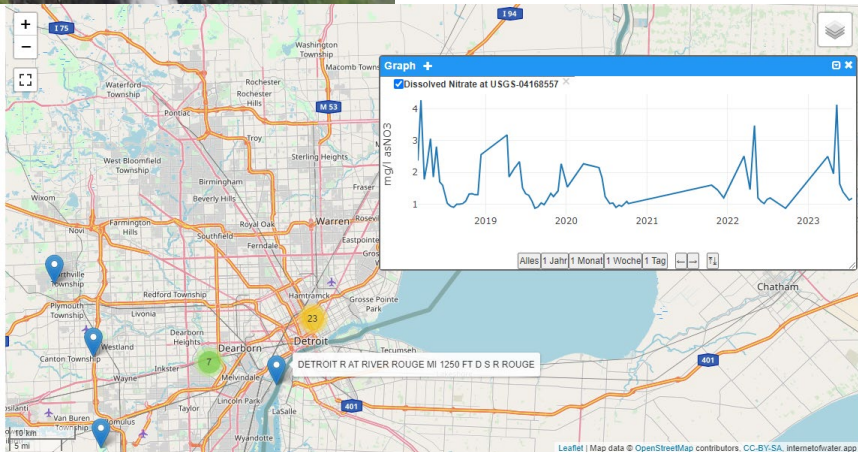


Implementation

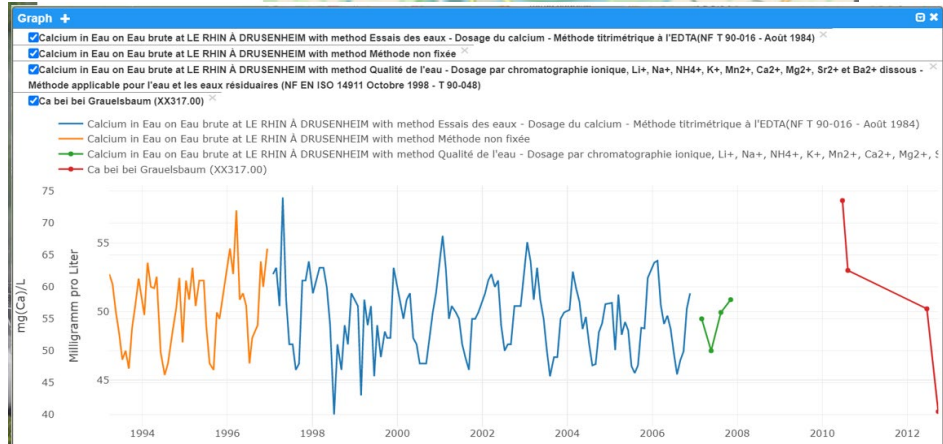
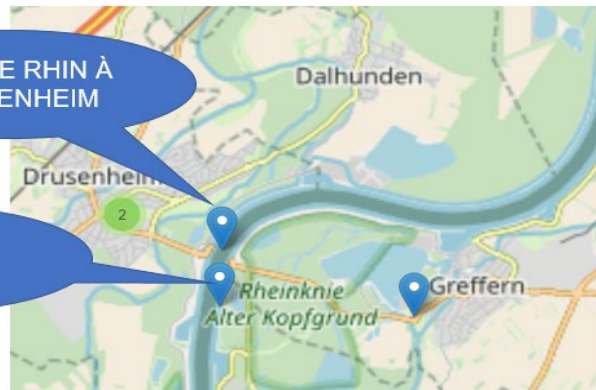
- How
 - Documentation being written
Google doc for now, will be moved to the GitHub when more mature
https://docs.google.com/document/d/1Oqjxrz8uY_Q9OKBwEM2ZufrCEnIYvA4vWIIJSiMyGT4/edit
 - Demo endpoints
 - Open Free-For-All Service (no data yet)
<https://ogc-demo.k8s.ilt-dmz.iosb.fraunhofer.de/FROST-WaterQuality/v1.1/>
 - USGS endpoint (work in progress)
Data: <https://wqp.wqie.internetofwater.app/FROST-Server/v1.1>
Map: <https://wqp.wqie.internetofwater.app/>
Map: <https://wg-brgm.k8s.ilt-dmz.iosb.fraunhofer.de/servlet/is/211/>
- Also tested in QGIS SensorThings API Plugin

Implementation

- It works !



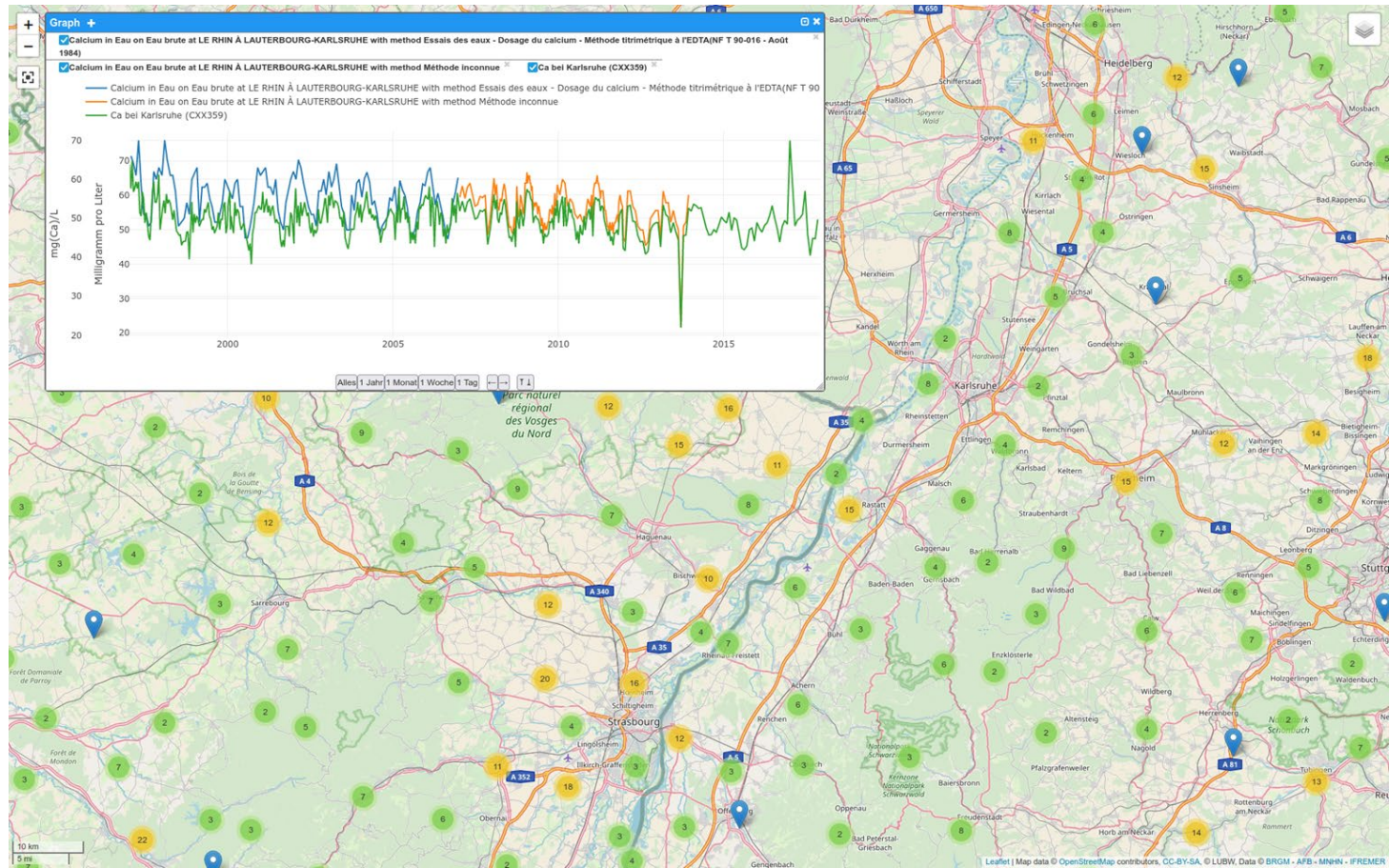
Surface water quality
 USGS – Internet of Water US



Surface water quality
 France - Germany

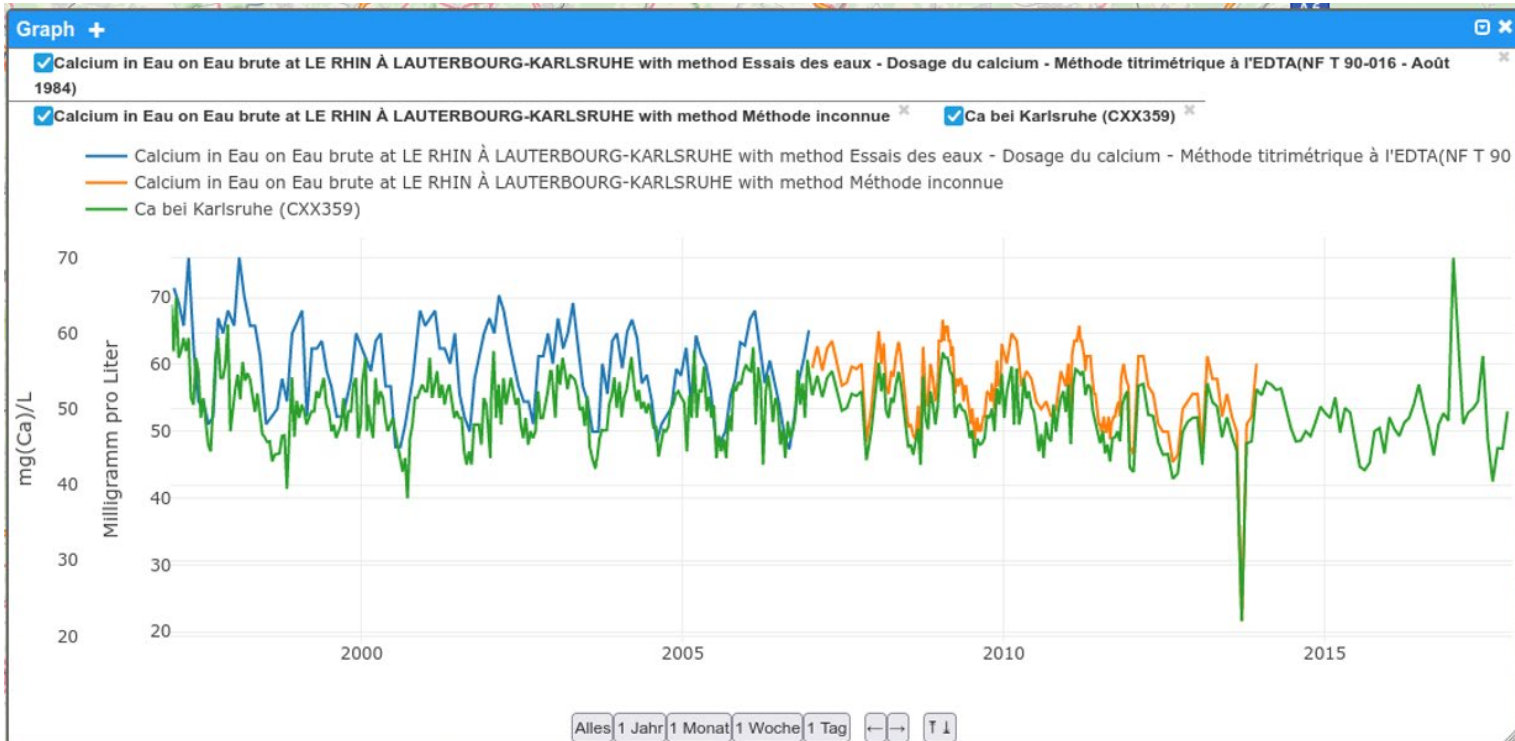
Implementation

- French & German Data
- 1 Map



Implementation

- French & German Data
- 1 Map





FAIR water quality data exchange thanks to international OGC water standards

Conclusion



Landing the Interoperability Experiment

- When
 - Current target => OGC Member Meeting in June 2024 (OGC Hydro DWG session)
- What
 - Demo based on the implementation feedback
 - + draft Engineering Report
 - summarizing the findings from the IE
 - and proposing next steps. Ex : adoption of a Best Practice for Water Quality data exchange Water ML2.0 Part 5 and (potentially) a revision of WaterML2.0 Part 1 : TimeSeries

Steps after the Interoperability Experiment

- Finalize a Best Practice for Water Quality data exchange Water ML2.0 Part 5 and start a draft revision of WaterML2.0 Part 1 : TimeSeries (to align with OMS and ST API)
- Work on shared 'controlled' vocabularies
 - Observed Property (? using I-ADOPT ?), Observing Procedure, ...
- Current UseCases
 - More implementations : La Plata basin countries (through WMO), more Water4All and GSEU project partners
- Address the other UseCases
 - Out of scope this IE : Biology (taxa observation), Hydro Models, Remote Sensing
⇒ Enough material for a WQ IE 2 😊



Some hindsight on the effort

- *How the new “Observations, measurements and samples (OMS)” is meaningful to the Interoperability Experiment ?*
 - Most of what is needed semantically is already within the OGC semantic baseline : OMS + OGC WaterML2.0 part 3 (HydroFeatures) and part 4 (GroundWaterML 2.0)
 - OGC SensorThings API 1.1 being already Observations & Measurements compliant we just needed to add the missing elements to make it OMS compliant (ex : MaterialSample and some others)
This is now embedded in SensorThings 2.0 working draft (revision ongoing)





Some hindsight on the effort

- *How the new “Observations, measurements and samples (OMS)” is meaningful to the Interoperability Experiment ?*



=> No need to reinvent the wheel, just use the available standards and document it



Some context supporting this work

- Some supporting national /EU projects from our end (both running now)



PROGRAMME NATIONAL
DE RECHERCHE SUR L'EAU



- French Research project, 53 Million €, 10 years
- <https://www.onewater.fr/en> (ANR project : 22-PEXO-0009)
- Many domain objectives including FAIR (interoperable) Water Data Exchange



- EU joint research partnership
- <https://www.water4all-partnership.eu/>
- 31 countries, 7 years, 81 Million € for the 2 years.
- Many domain objectives including FAIR (interoperable) Water Data Exchange

- Your project could join the effort
⇒ join the OGC Hydro DWG discussions

Thank to

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