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& Samples!

# OGC/ISO Observations & Measurements and the OGC SensorThings API

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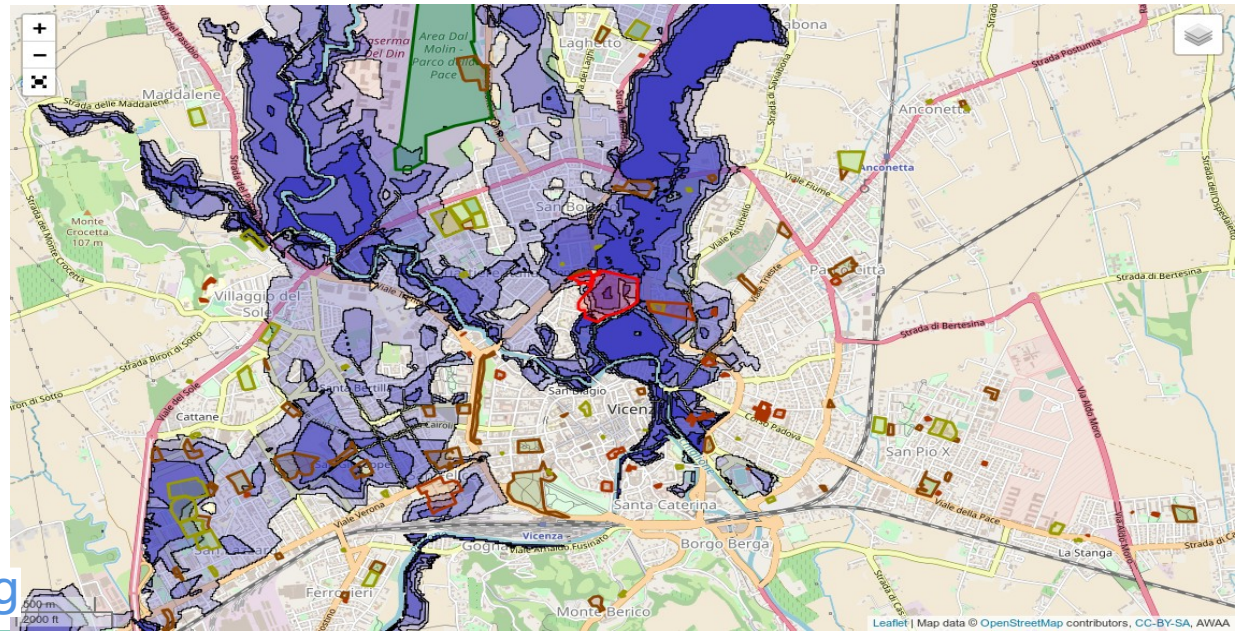
Hylke van der Schaaf



**Fraunhofer**  
IOSB

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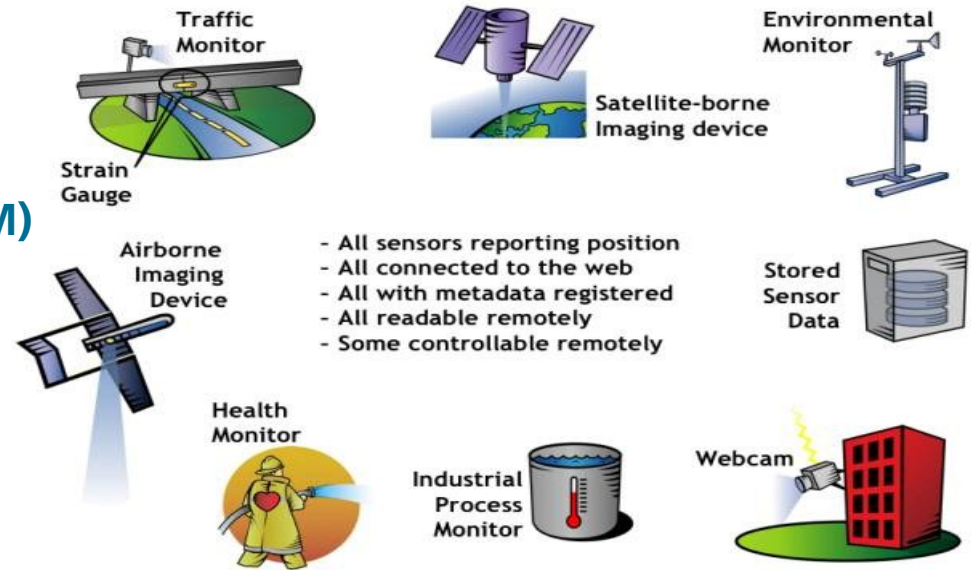
- International consortium
  - over 540 companies, government agencies and universities
- “Geo-enable” mainstream IT
- Develop publicly available interface standards
  - Maps (Web Map Service)
  - CityGML
  - WaterML
  - Earth Observations
- Conformance testing



■ <http://www.opengeospatial.org>

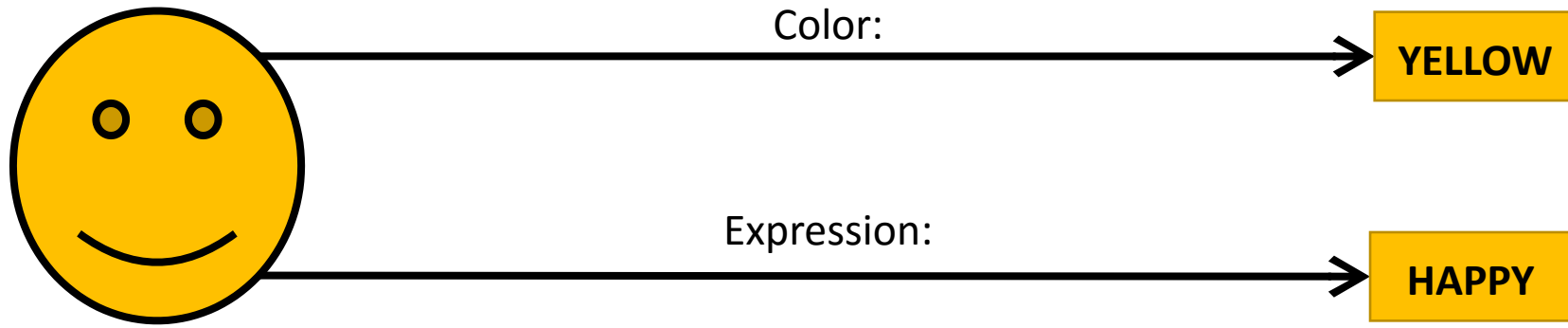
# OGC, Observations & Internet of Things?

- Observations are made **somewhere!**
- Often by Sensors
- OGC Sensor Web Enablement (SWE)
  - Enable developers to make *all types* of sensors, transducers and sensor data repositories discoverable, accessible and useable via the Web
  - Since 1990 by NASA
  - Since 2001 in OGC
  - SensorML
  - **Observations & Measurements (O&M)**
  - **SensorThings API**
  - Sensor Data & Metadata

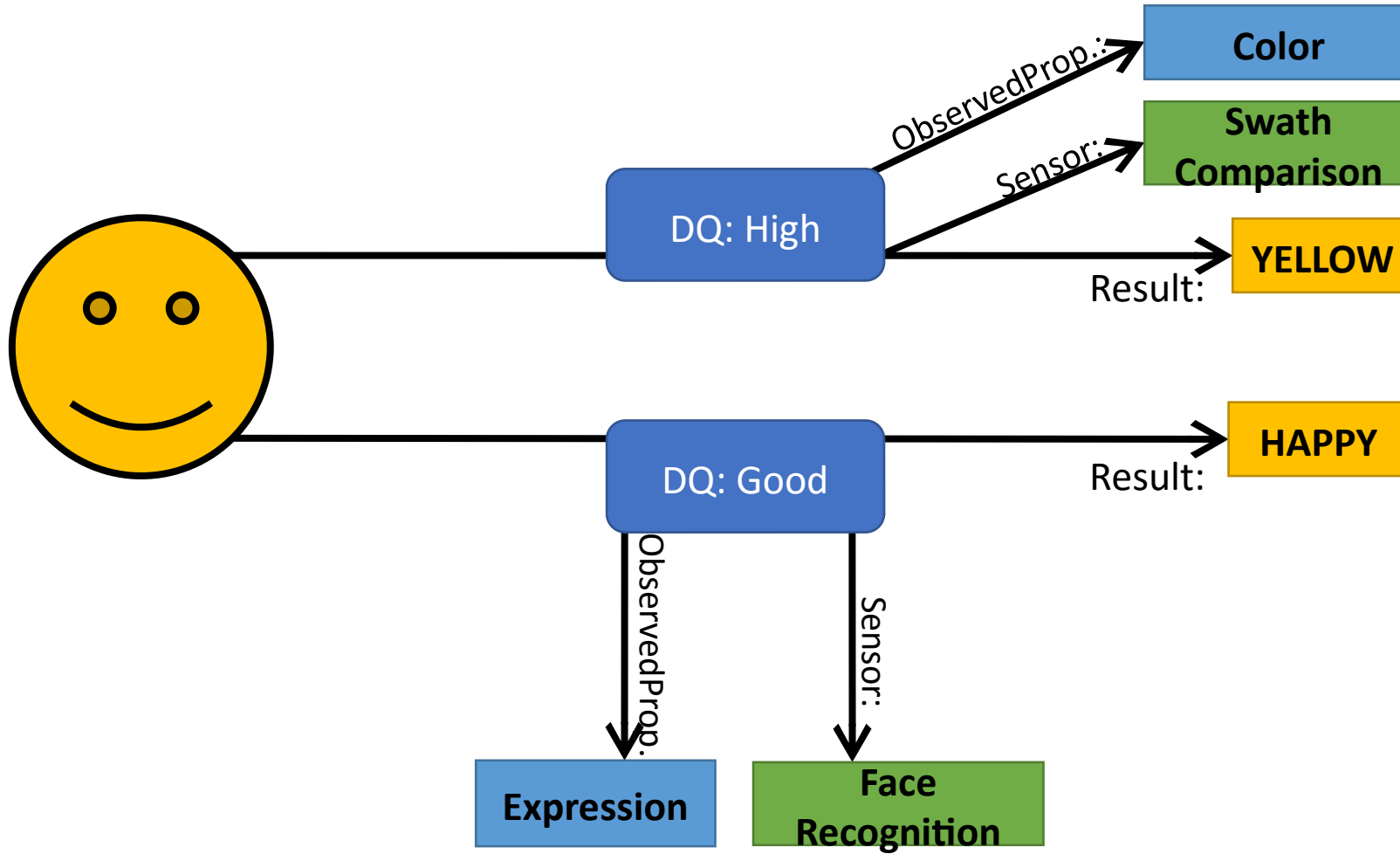


©OGC: <http://www.opengeospatial.org/ogc/markets-technologies/swe>

# Observational (Meta)Data



# Observational (Meta)Data



## A cartoon illustration of a person's head and shoulders in the bottom left corner, looking upwards. A large, blue, cloud-like thought bubble originates from the person's head, containing three white question marks. The background is a solid light blue.



# Using Observational (Meta)Data

Data  
Quality  
?

Methodology  
?

UoM  
?

## Observations & Measurements Model

Object	Descriptor	Reference
Face1	Color	Yellow
Face1	Expression	Happy
Face1	Name	John
Face1	Color	Yellow
Face2	Expression	Unhappy
Face2	Name	Bob
Face3	Color	Blue
Face3	Expression	Neutral
Face3	Name	John

Object	Descriptor	Reference
Face2	Color	Green
Face2	Expression	Unhappy
Face2	Name	Bob
Face3	Color	Blue
Face3	Expression	Neutral
Face3	Name	Mary





# Sensor Metadata!

Wired Nov. 10, 1999: Metric Math Mistake Muffed Mars Meteorology Mission

LISA GROSSMAN 11.10.10 07:00 AM

## NOV. 10, 1999: METRIC MATH MISTAKE MUFFED MARS METEOROLOGY MISSION



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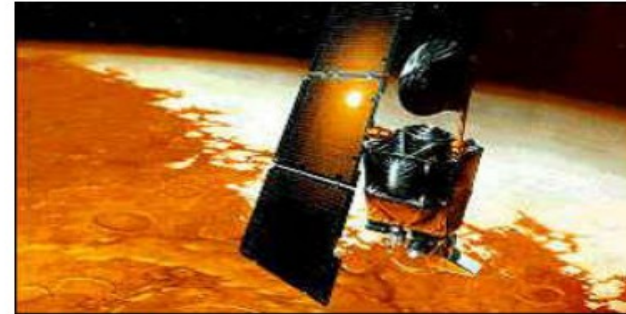
[Low Graphics](#)

[Help](#)

Thursday, September 30, 1999 Published at 18:53 GMT 19:53 UK

### Sci/Tech

## Confusion leads to Mars failure



The Mars Climate Orbiter: Now in pieces on the planet's surface

The Mars Climate Orbiter Spacecraft was lost because one Nasa team used imperial units while another used metric units for a key spacecraft operation.

### Sci/Tech Contents

#### Relevant Stories

24 Sep 99 | Sci/Tech  
[Scientist fights Mars setback](#)

23 Sep 99 | Sci/Tech  
[Mars probe feared destroyed](#)

23 Sep 99 | Sci/Tech  
[What the loss of Mars Climate Orbiter means](#)

17 Jul 99 | Sci/Tech  
[Astronauts call for Mars mission](#)

### Internet Links

[Mars Climate Orbiter](#)

The BBC is not responsible for the content of external internet sites.



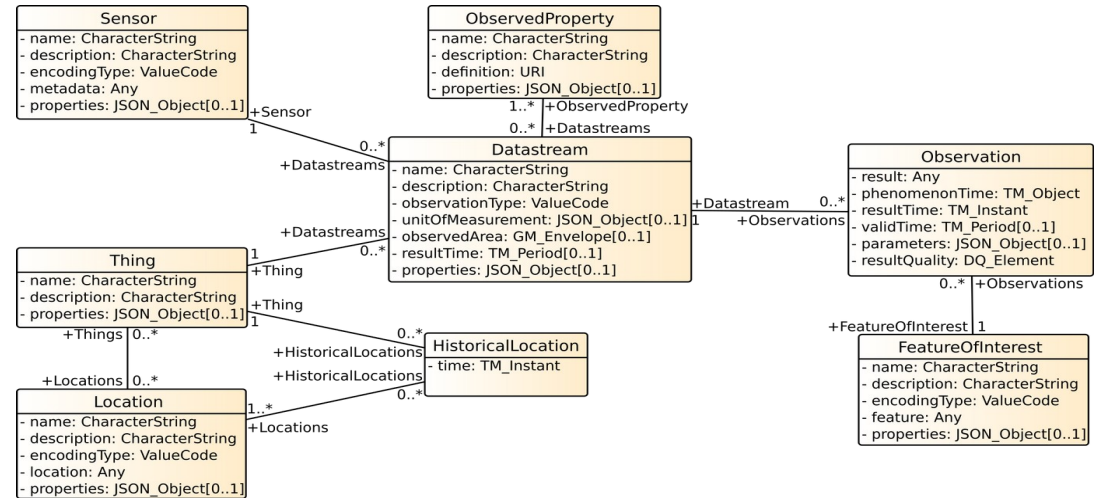
# OGC SensorThings API

- A 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

# How does it work?

## ■ Section 1: Data model

- Which entities exist
- How are they linked

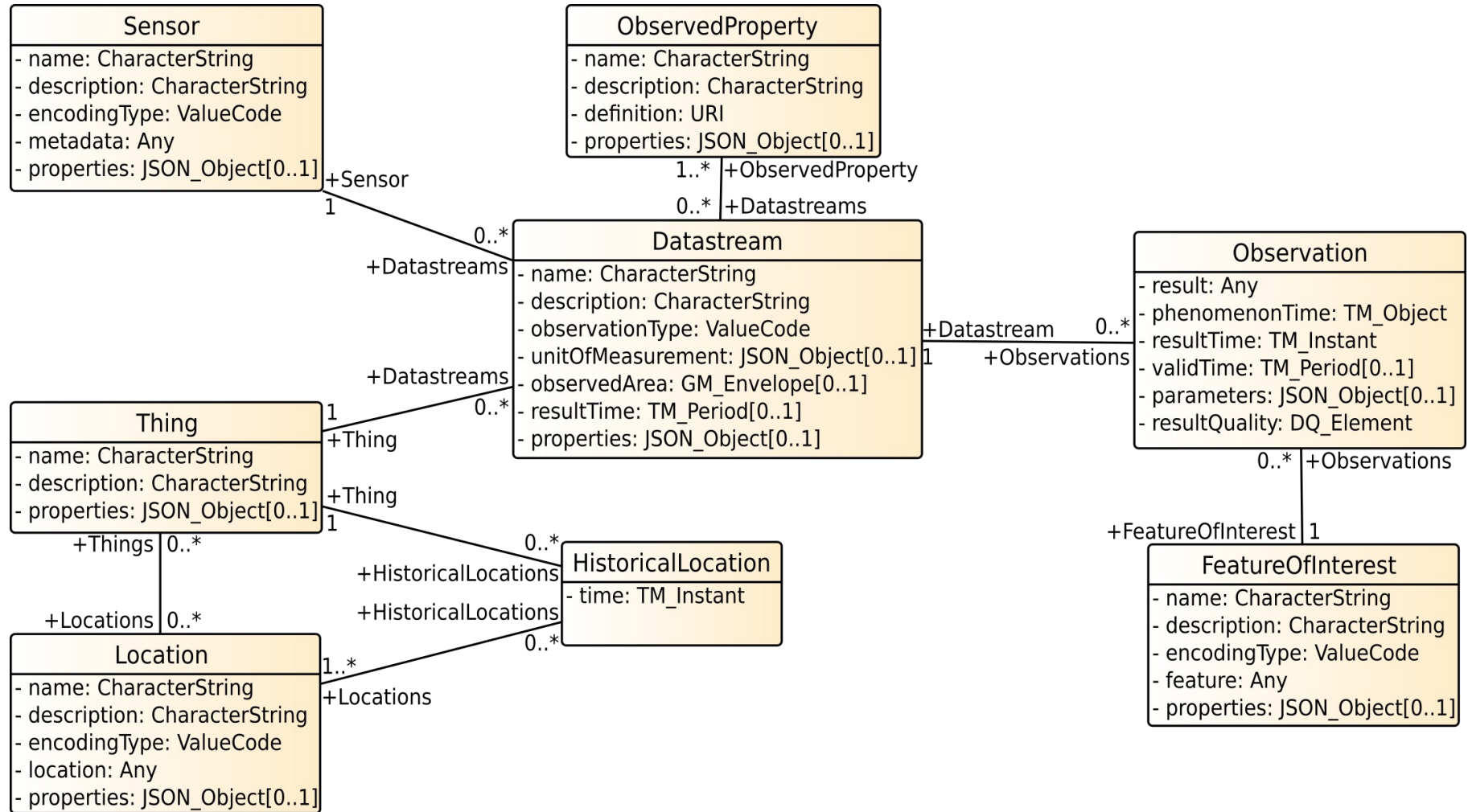


## ■ Section 2: URL patterns for queries

- How do I get & search data
- How do I add data
- How do I modify data
- How do I delete data

REST  
&  
MQTT

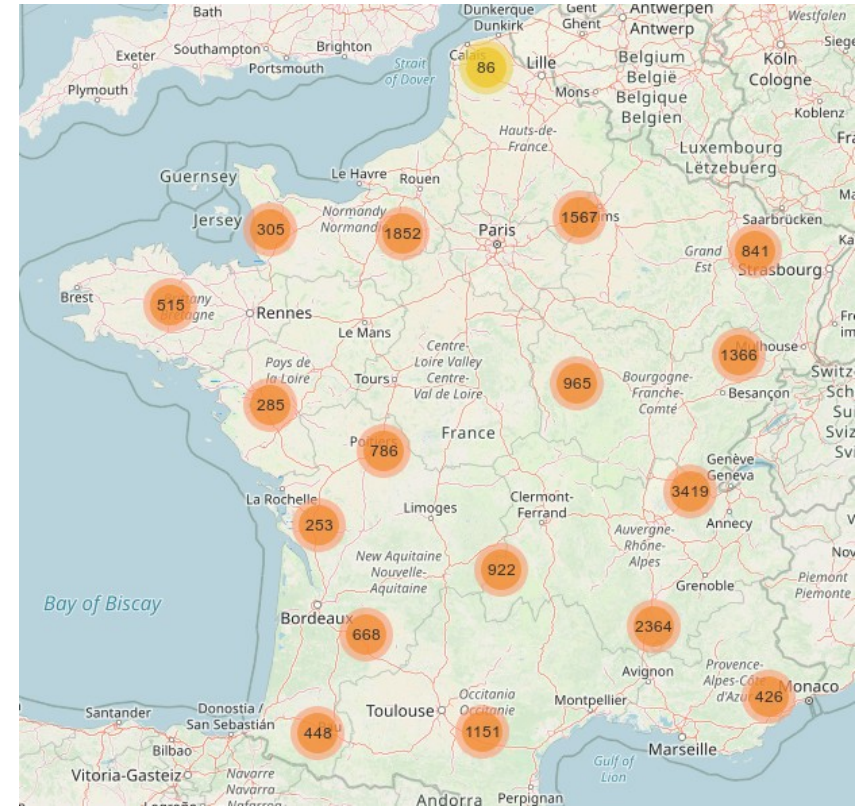
# Data model



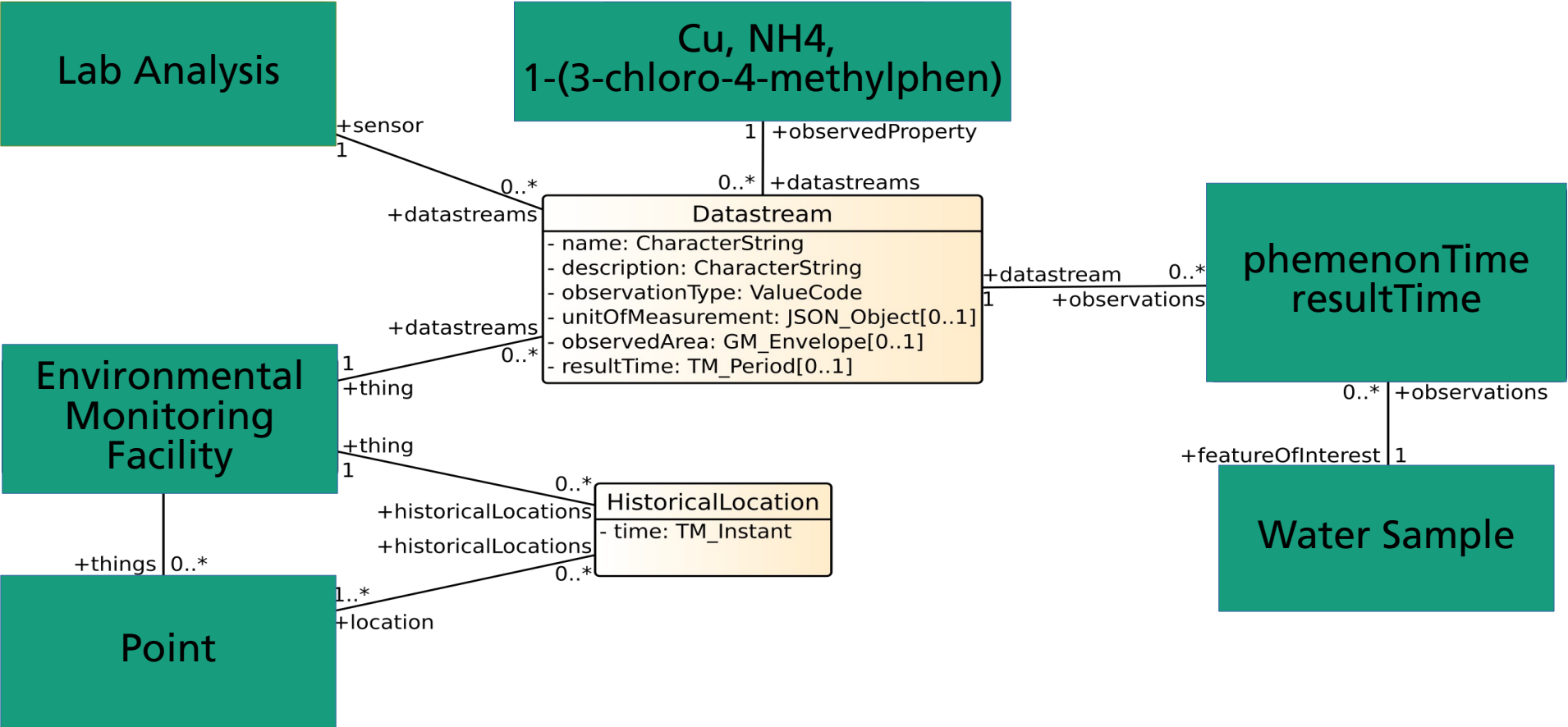
# Examples: BRGM – French surface water database

## ■ French surface water quality database

- 18478 Stations
- 1874 Observed Properties
- 136000000 Observations
- INSPIRE Aligned
- Water samples
  - analysed in laboratory
  - many results per sample



# Data model – BRGM Water Quality



# Getting to your data

- Based on OASIS OData

- Base URL: <http://server.de/FROST-Server/v1.1>

- Read: GET

- v1.1 → Get collection index
- v1.1/Collection → Get all entities in a collection
- v1.1/Collection(id) → Get one entity from a collection
- v1.1/Collection(id)/Relation → Get related entities

- Create: POST

- v1.1/Collection → Create a new entity

- Update: PATCH

- v1.1/Collection(id) → Update an entity

- Update: PUT

- v1.1/Collection(id) → Replace an entity

- Delete: DELETE

- v1.1/Collection(id) → Remove an entity

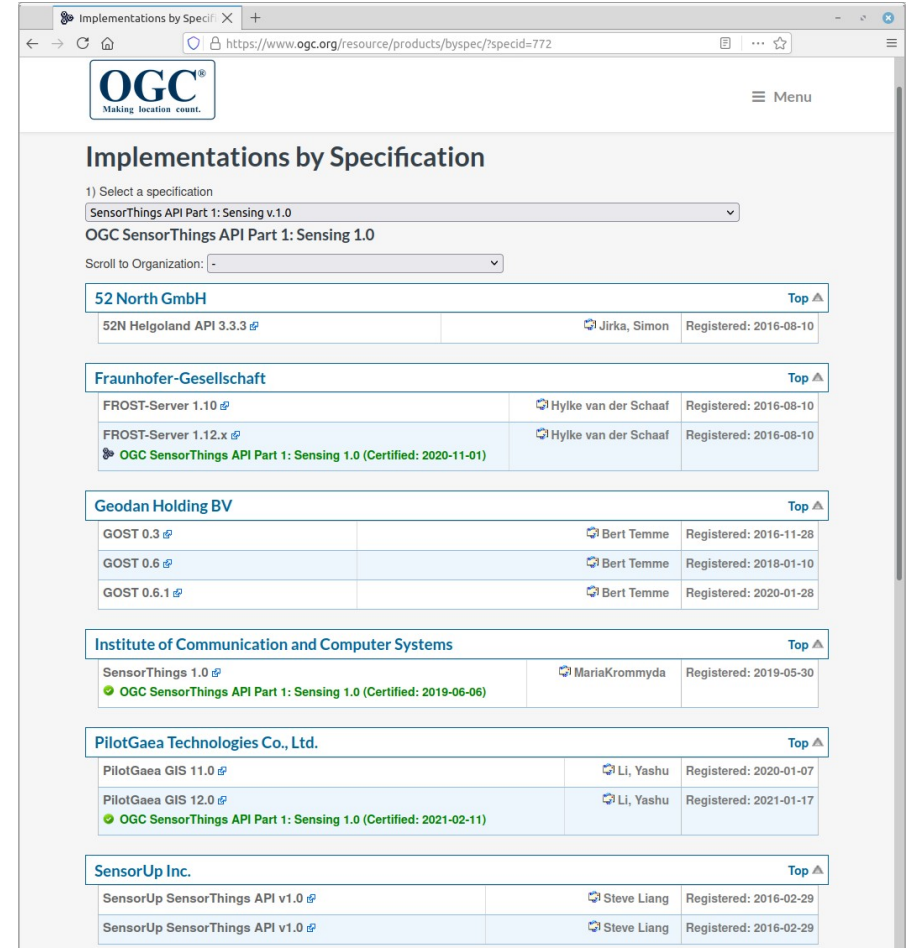


# Getting to your data

- **\$stop**: Limit returned # of items
- **\$skip**: Skip first # items
- **\$count**: Count items
- **\$orderBy**: Sort items
- **\$select**: Limit returned properties
- **\$filter**: Filter items
- **\$expand**: Return related items

# STA Implementations

- A standard that is not implemented is useless
- A standard with only 1 implementation is also useless



The screenshot shows the OGC website's 'Implementations by Specification' page. The page title is 'Implementations by Specification'. Below the title, there is a dropdown menu for 'Select a specification' with 'SensorThings API Part 1: Sensing v1.0' selected. Below this, there is a dropdown for 'OGC SensorThings API Part 1: Sensing 1.0'. A 'Scroll to Organization' dropdown is also present. The page lists several organizations and their implementations:

Organization	Implementation	Person	Registered
52 North GmbH	52N Helgoland API 3.3.3	Jirka, Simon	Registered: 2016-08-10
Fraunhofer-Gesellschaft	FROST-Server 1.10	Hylke van der Schaaf	Registered: 2016-08-10
Fraunhofer-Gesellschaft	FROST-Server 1.12.x	Hylke van der Schaaf	Registered: 2016-08-10
Fraunhofer-Gesellschaft	OGC SensorThings API Part 1: Sensing 1.0 (Certified: 2020-11-01)		
Geodan Holding BV	GOST 0.3	Bert Temme	Registered: 2016-11-28
Geodan Holding BV	GOST 0.6	Bert Temme	Registered: 2018-01-10
Geodan Holding BV	GOST 0.6.1	Bert Temme	Registered: 2020-01-28
Institute of Communication and Computer Systems	SensorThings 1.0	MariaKrommyda	Registered: 2019-05-30
Institute of Communication and Computer Systems	OGC SensorThings API Part 1: Sensing 1.0 (Certified: 2019-06-06)		
PilotGaea Technologies Co., Ltd.	PilotGaea GIS 11.0	Li, Yashu	Registered: 2020-01-07
PilotGaea Technologies Co., Ltd.	PilotGaea GIS 12.0	Li, Yashu	Registered: 2021-01-17
PilotGaea Technologies Co., Ltd.	OGC SensorThings API Part 1: Sensing 1.0 (Certified: 2021-02-11)		
SensorUp Inc.	SensorUp SensorThings API v1.0	Steve Liang	Registered: 2016-02-29
SensorUp Inc.	SensorUp SensorThings API v1.0	Steve Liang	Registered: 2016-02-29

# Questions?

## ■ Hylke van der Schaaf

- [hylke.vanderschaaf@iosb.fraunhofer.de](mailto:hylke.vanderschaaf@iosb.fraunhofer.de)

## ■ O&M

- <https://www.ogc.org/standards/om>
- [https://en.wikipedia.org/wiki/Observations\\_and\\_Measurements](https://en.wikipedia.org/wiki/Observations_and_Measurements)

## ■ SensorThings API

- <https://www.ogc.org/standards/sensorthings>

## ■ FROST-Server

- <https://github.com/FraunhoferIOSB/FROST-Server>
- <https://fraunhoferiosb.github.io/FROST-Server/>