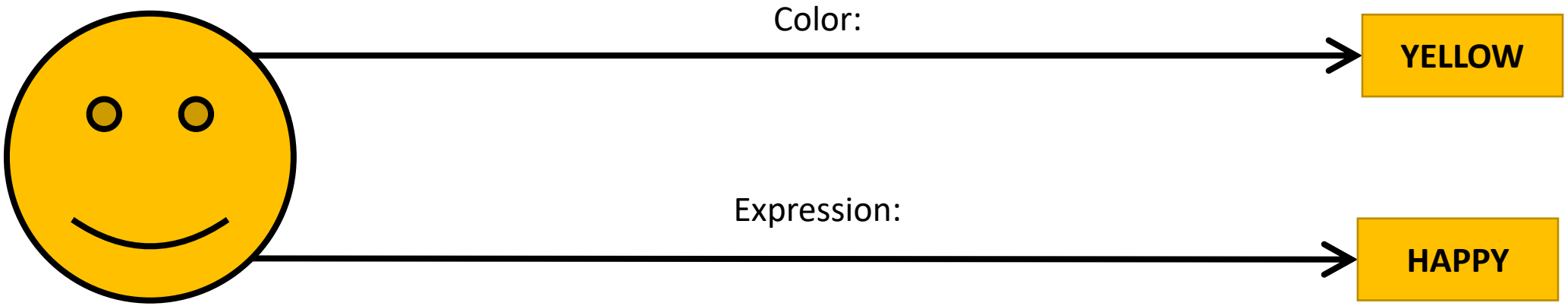
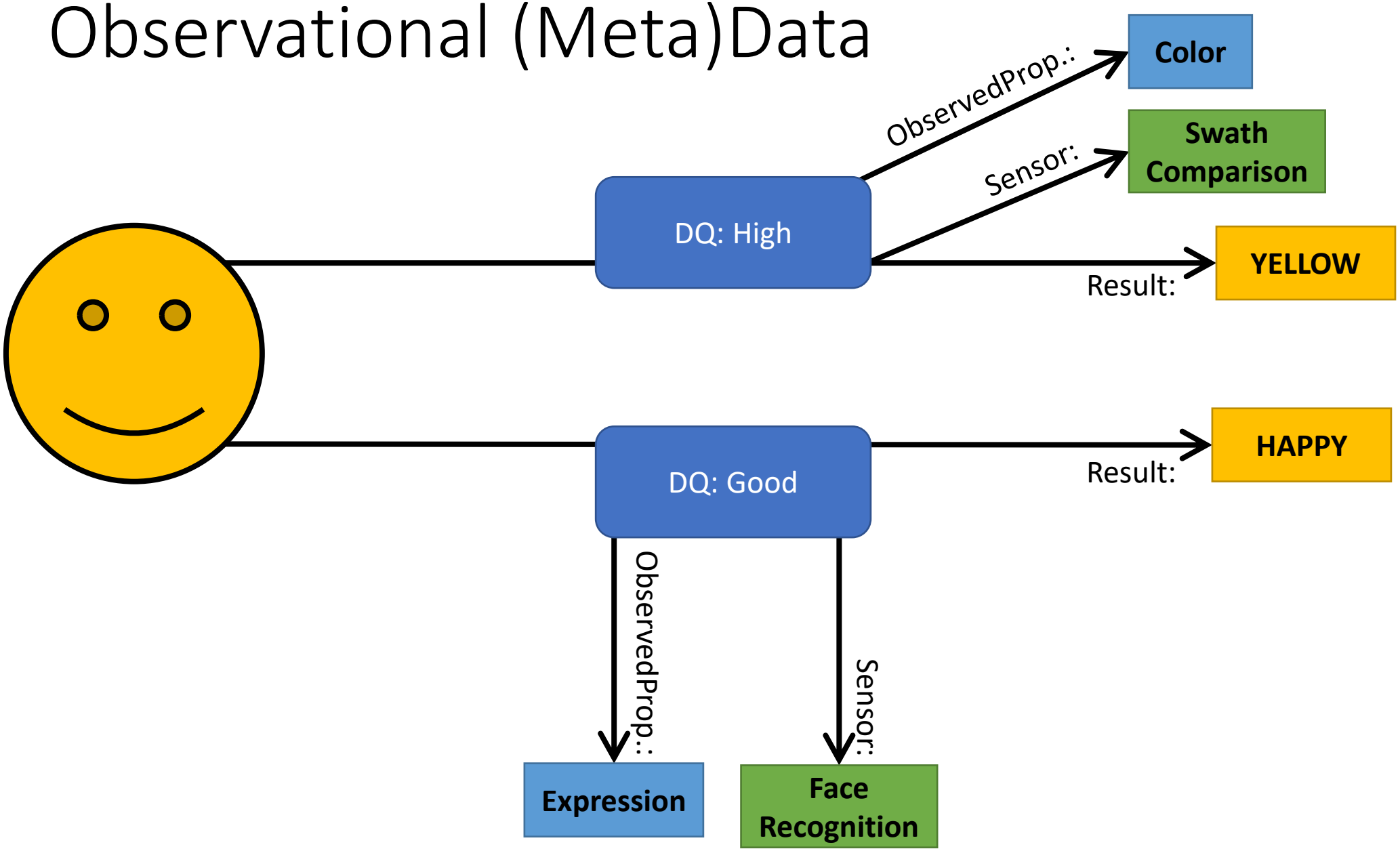
Dynamic and Observational Spatial Data

Bridging the Gap

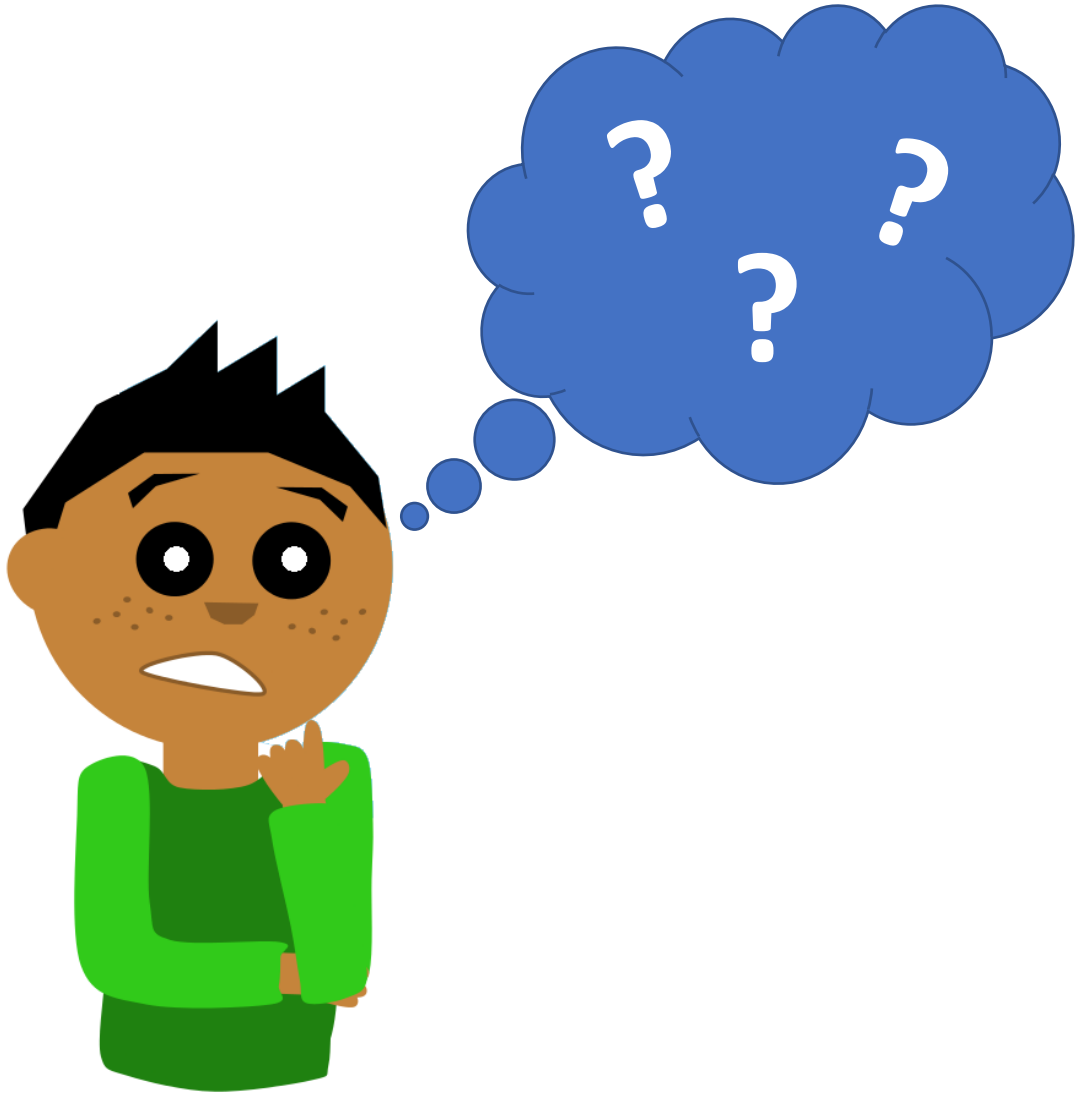
Observational (Meta)Data

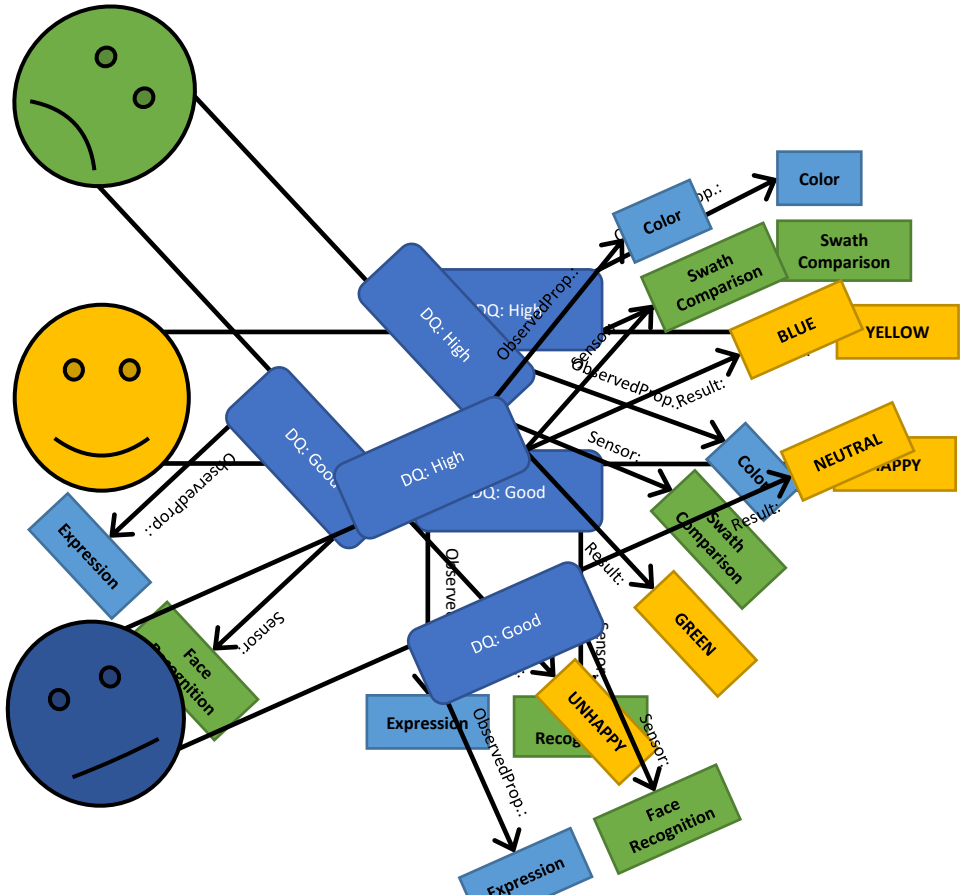


Observational (Meta)Data

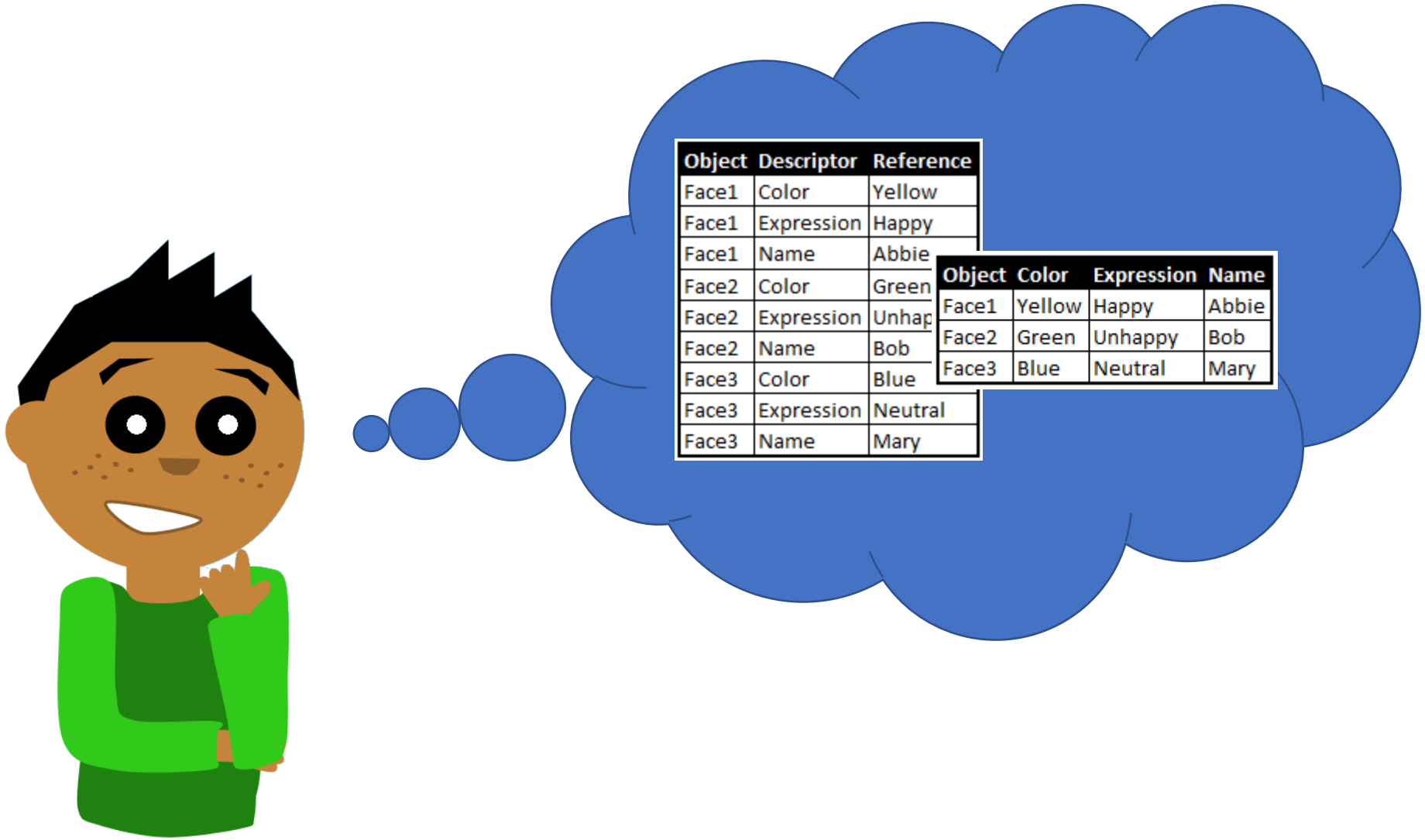


Using Observational (Meta)Data





Using Observational (Meta)Data



Object	Descriptor	Reference
Face1	Color	Yellow
Face1	Expression	Happy
Face1	Name	Abbie
Face2	Color	Green
Face2	Expression	Unhap
Face2	Name	Bob
Face3	Color	Blue
Face3	Expression	Neutral
Face3	Name	Mary

Object	Color	Expression	Name
Face1	Yellow	Happy	Abbie
Face2	Green	Unhappy	Bob
Face3	Blue	Neutral	Mary

Using Observational (Meta)Data

Data Quality?

Methodology?

UoM?

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SensorThings API V1.1

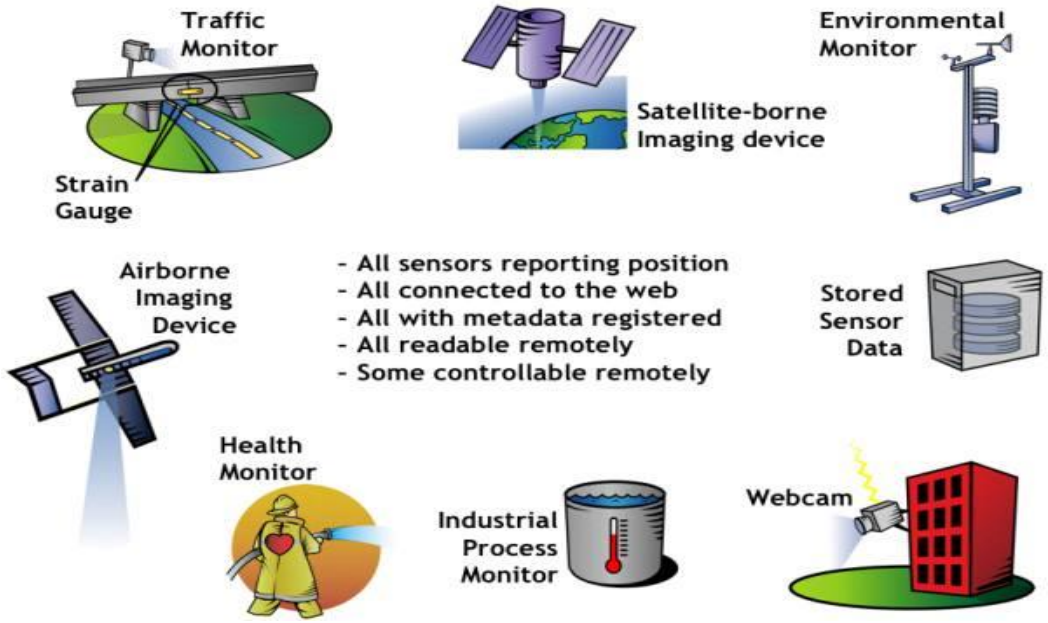
OGC & Sensor Measurements

- Sensors, Actuators & Simulations usually have Location
- 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
    - Sensor Observation Service (SOS)
    - Web Processing Service (WPS)
    - Sensor Planning Service (SPS)
    - Observations & Measurements (O&M)
    - SensorThings API (STA)
  - Sensor Data & Measurement Metadata
  - Core of INSPIRE

OGC®
Making location count.

Relevant Domains (on beyond Sensors)

- Environmental:
  - Air quality, Meteorology
  - Water quality and quantity
  - Biodiversity occurrence data
  - Soil and Geological data
- Demography
- BMS
- Industry 4.0
- Smart Cities
- …



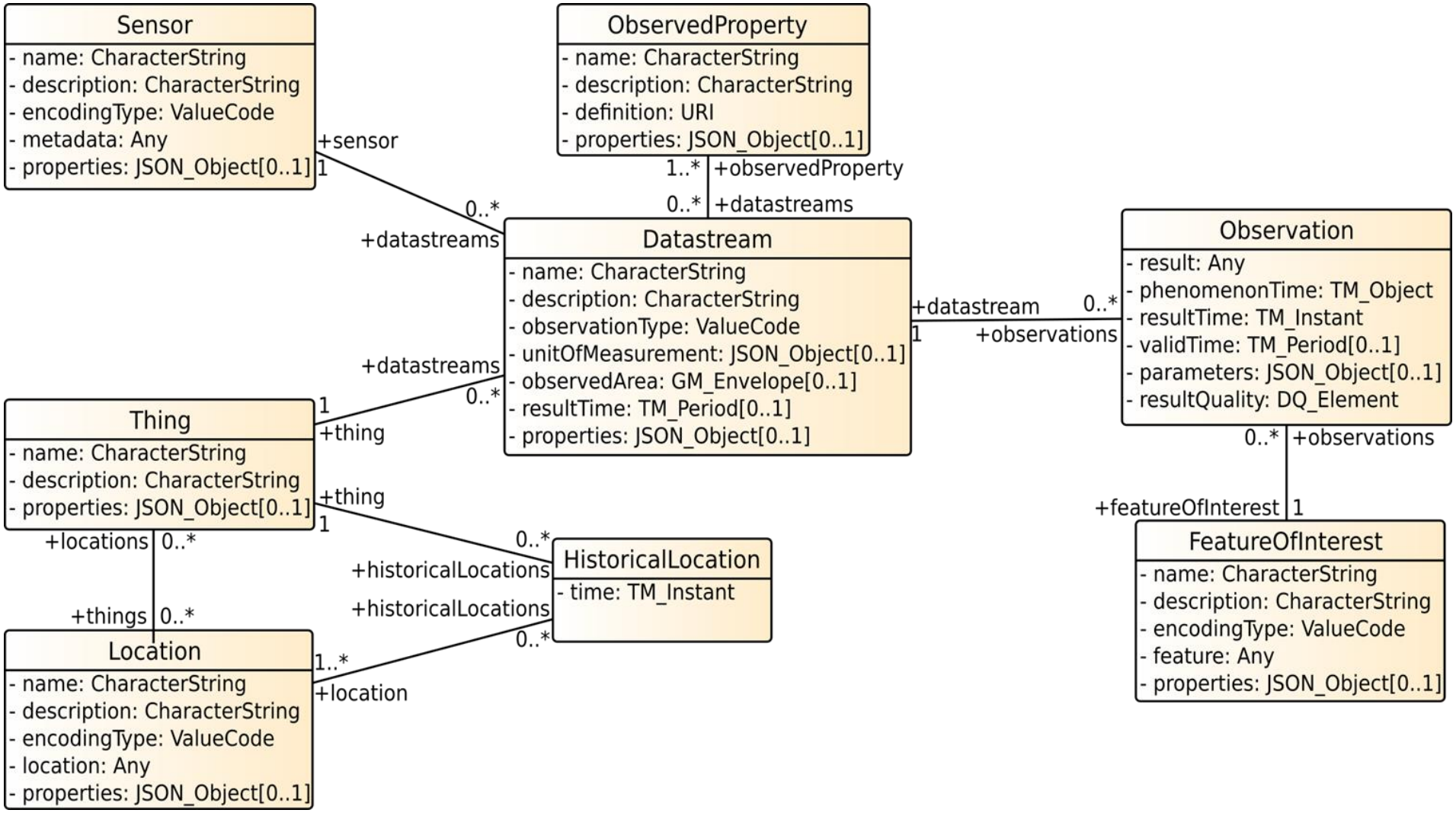
©OGC: http://www.opengeospatial.org/ogc/markets-technologies/swe

OGC SensorThings API

- A standard for exchanging sensor data and measurement 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



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
- 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

MQTT

Query Parameters

- $skip: pagination
- $top: pagination
- $count: entity count
- $select: result customization
- $expand: result customization
- $filter: data search

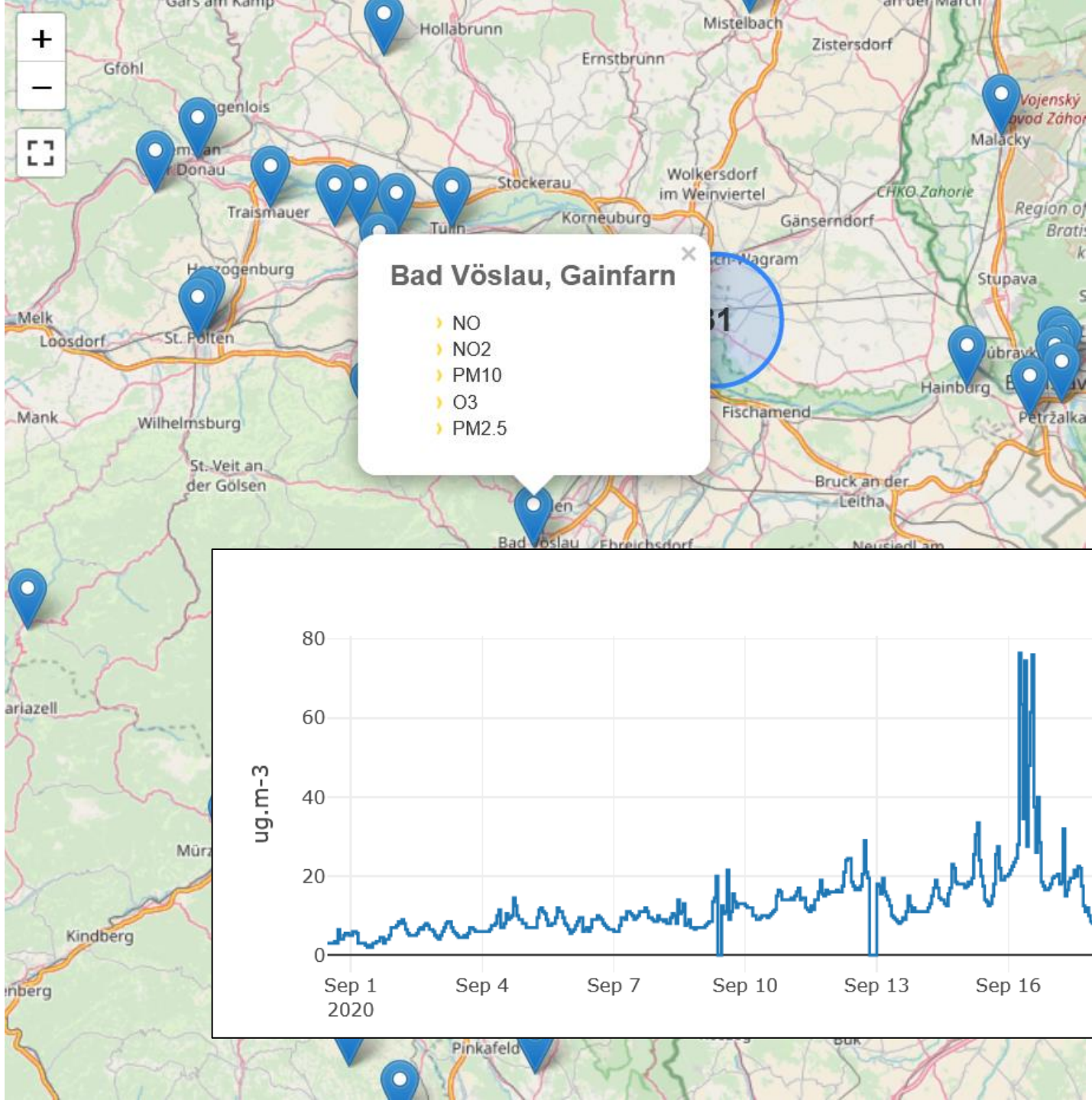
STA Query Logic

Query Logic differs from basic spatial feature APIs

- Data is not static in time – may change during viewing
- Data is not tile-based
- Multiple dimensions through underlying complex data model
  - Time series data
  - Observed Properties
- Massive not-tile-based data, requires intelligent queries depending on
  - Zoom level
  - Presentation requirements – displaying location vs. data time-series
- Complex queries across multiple objects core in STA

→ Additional support required, existing tools for static data don’t fulfil requirements

Realtime Air Quality



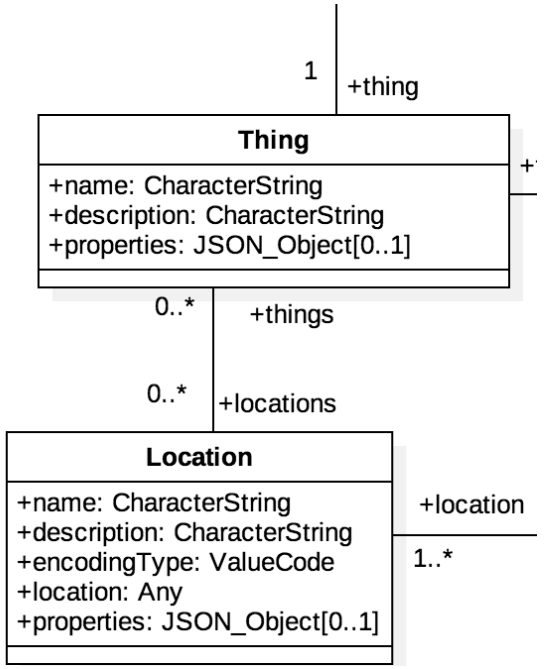
Multi Resolution Data

- European NUTS regions with demography data
  - Regions in 5 scales. Which to choose?
- A STA Thing can have multiple Locations (Geometries)

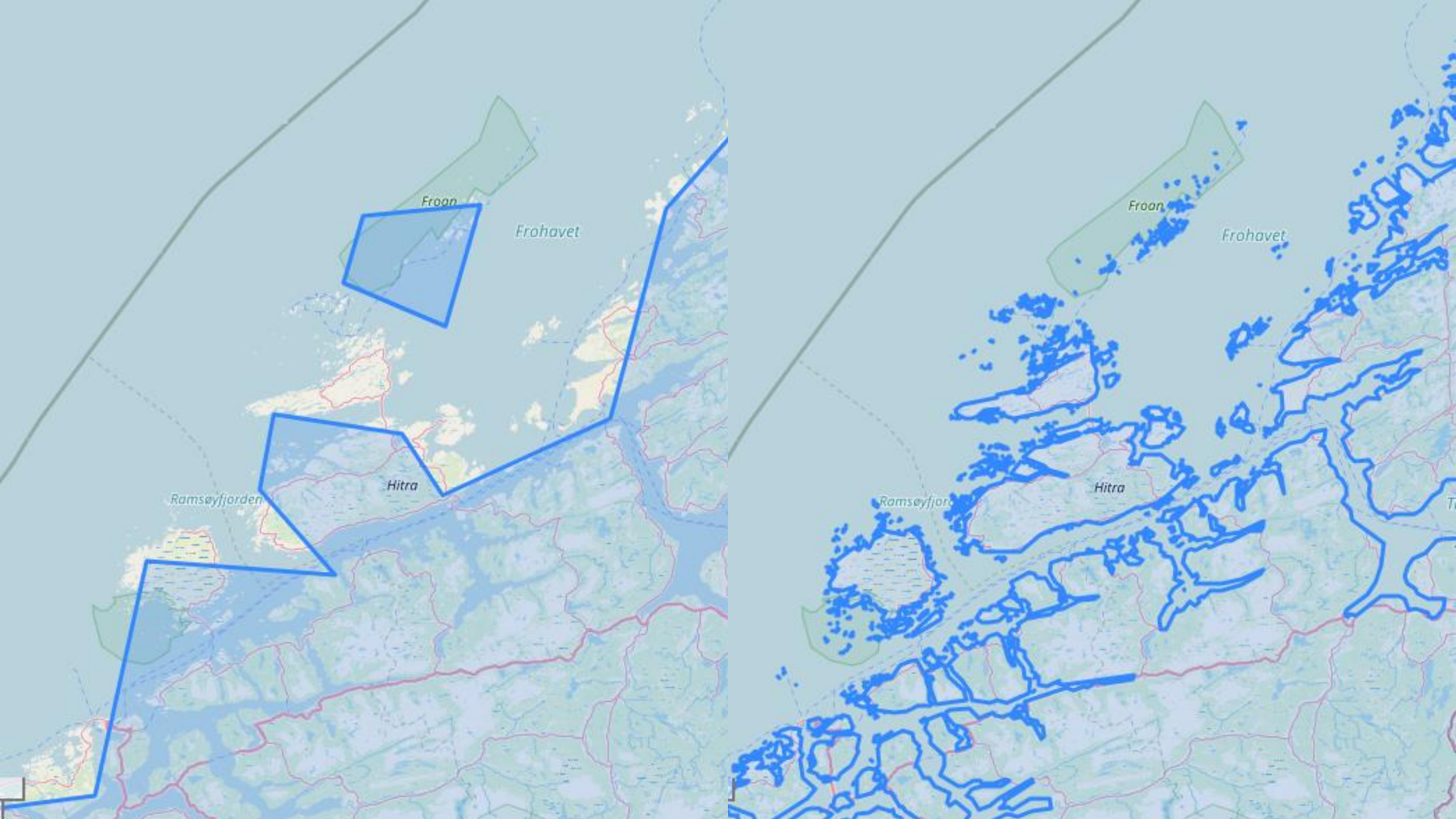
  →Add All scales!

  →Store the scale for each in the Location properties

  →Build cool queries!



https://api4inspire.k8s.ilt-dmz.iosb.fraunhofer.de/servlet/is/163/


Froan
Frohavet
Hitra
Ramsøyfjorden
Froan
Frohavet
Hitra
Ramsøyfjor

STA Mapper - STAM

- JavaScript library
- Displays Things/Features-of-Interest
- Handles groupings by zoom level
- Integrated call-back for displaying time series
- Integrates with Leaflet/OpenLayers map.

https://github.com/DataCoveEU/STAM

STAM Functionality

- Display Things/FoIs on Map
  - Takes zoom level into account
  - For tiles with many entities, only count requested
  - Groupings based on OSM Tiles
  - Custom Icons, influenced by response data
- Identify Things/FoIs
  - All associated Datastreams listed
- Show Observations
  - Callback can be configured for custom display
  - Plotly integrated for default display of time series

STAM Configuration Options

- baseUrl: string *//The base url of the Sensorthings API*
- markerStyle?: Function | string *//Specifies the color of the marker. Functions get geoJSON as parameter*
- clusterStyle?: Function *//Used to specify the style of the circle or polygon*
  - circle
  - polygon
- markerMouseOver?: Function *//Callback receiving feature on marker hover*
- markerClick?: Function *//Callback receiving feature on marker click*
- clusterMouseOver?: Function *//Callback receiving feature on cluster hover*
- clusterClick?: Function *//Callback receiving feature on cluster click*

STAM Configuration Options II

- plot:{} *// Temporal range for plot. Offset OR endDate may be specified*
- cachingDuration: number *//Time in seconds to cache the data. null = forever*
- cluster: Boolean *//Defaults to true, if false no clustering applied*
- clusterMin: number *//Minimal count within tile, so that a cluster is displayed*
- queryObject:{} *//Can be a array of a ranges or directly a queryObject. Queries can be specified for given zoomlevels or ranges.*

Conclusions

- SensorThings API is being increasingly deployed
- New domains still discovering power of STA
- Map based visualization still in development
- STAM a first approach to providing simple mapping support

More examples and demos at:

https://datacoveeu.github.io/API4INSPIRE/

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Thanks for your Attention!

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