Environnemental Sensing

Observation

Présentation

What is an Observation ?

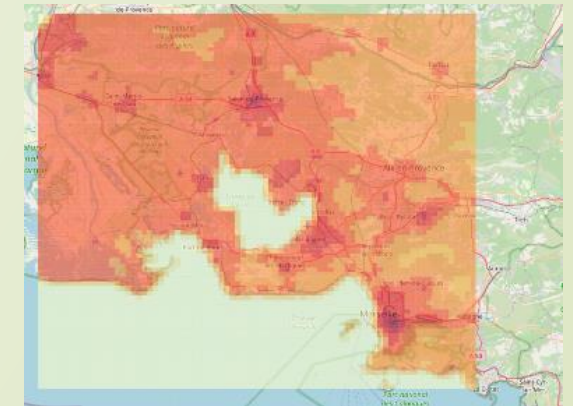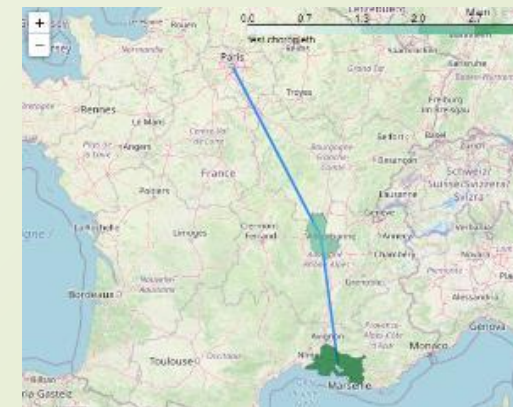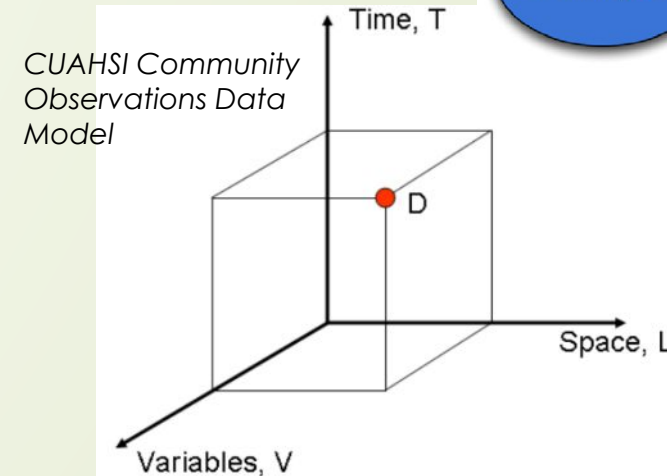**ISO 19156 - Observation and measurement**
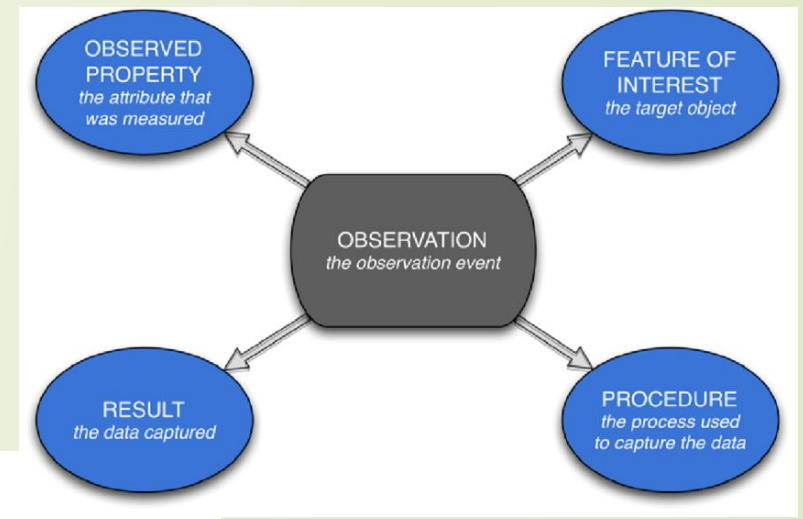- Result (qualitative or quantitative)
- Observed property (Variable)
- Feature of Interest (Location)
- Time (phenomenon, result, valid)
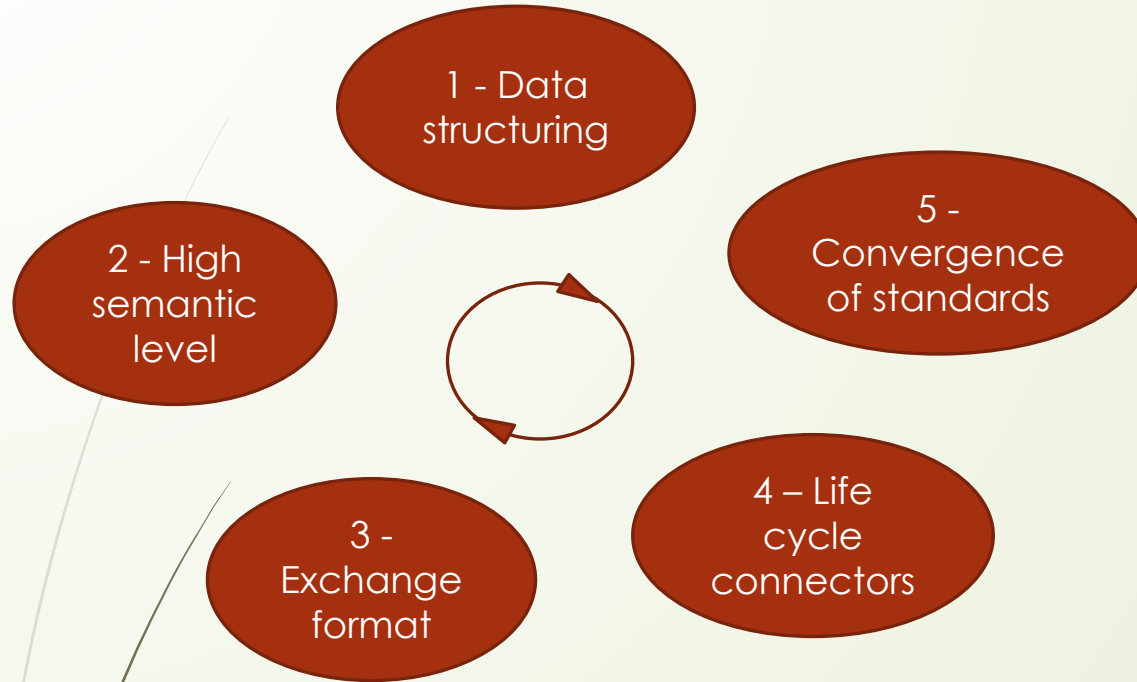- Procedure (instrument)

Data model
- Variable (every kind of data)
- List of indexes
  - Location, Datation, Property...

Structure
- multi-dimensions
- indexed list or indexed matrix

CUAHSI Community Observations Data Model

Five Pilars

Five Principles

1 - Data structuring

5 - Convergence of standards

2 - High semantic level

3 - Exchange format

4 – Life cycle connectors

Low data
- No duplication
- No unnecassary data

Openness
- Any data type
- Any entry point

Consistency
- Alteringless
- Aggregation

Simplicity
- Tools availability

Convergence

Process

Data production

Aggregation

Extraction

Data structuring

Structuration

pandas

*x*array

scikit *learn*

NumPy

Data exploitation
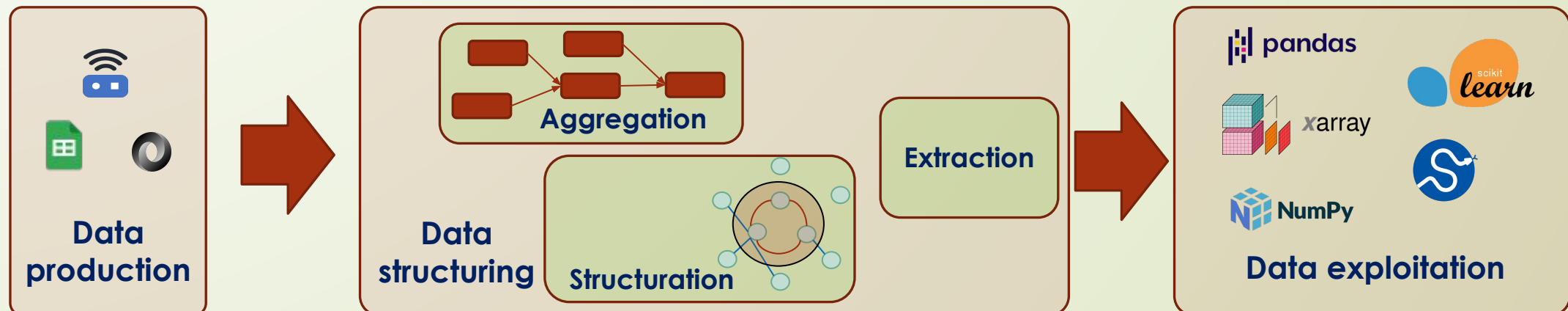
1 – Data structuring

List of values :

Temperature : [12, 28, 39, 58]

+ **List of indexes :**

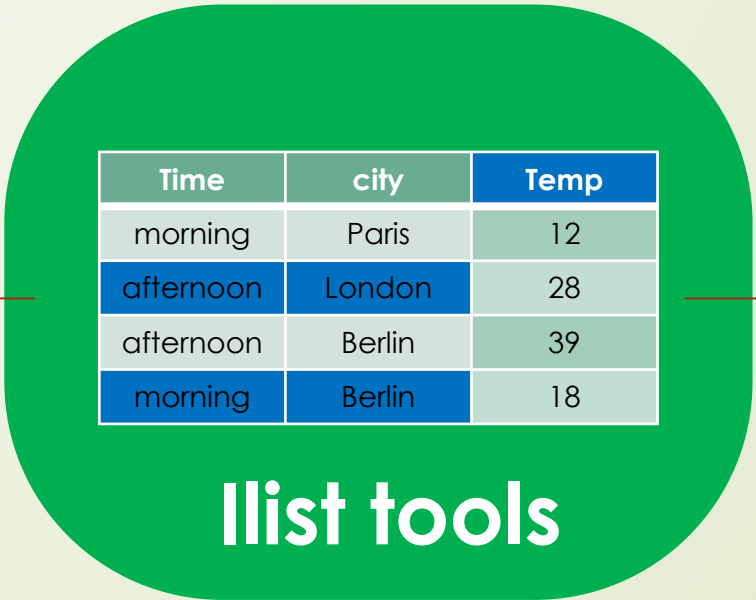Time : [morning, afternoon]

City : [Paris, London, Berlin]

….

Time	city	Temp
morning	Paris	12
afternoon	London	28
afternoon	Berlin	39
morning	Berlin	58

Time	city	Temp
morning	Paris	12
afternoon	London	28
night	Berlin	10

i.e. Trip
(dimension 1)

llist tools

Time	city	Temp
morning	Paris	12
afternoon	London	28
afternoon	Berlin	39
morning	Berlin	18

Time	city	Temp
morning	Paris	12
afternoon	London	28
afternoon	Berlin	39
morning	Berlin	18
afternoon	Paris	31
morning	London	10

i.e. Measuring station
(dimension 2)

2 – High semantic level

Structured value

Value   NameValue

Value :
(object)

Object
(any)

Value :
(composed)

TimeSlot   Coordinate (geojson)   Property

datetime   Position (geojson)   Characteristic

Value :
(elementary)

string   byte   number   Array (list)   Object (dict)
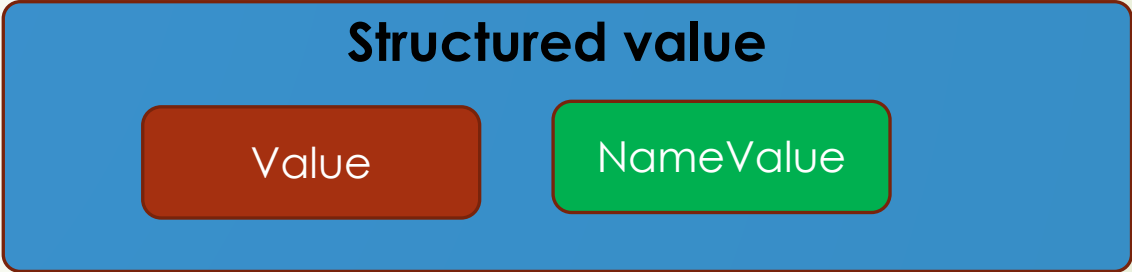
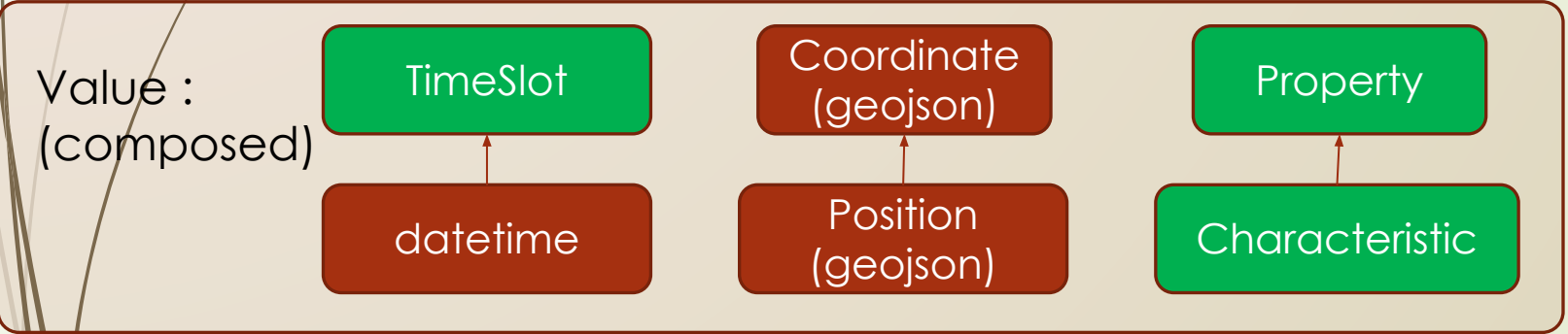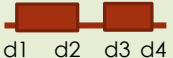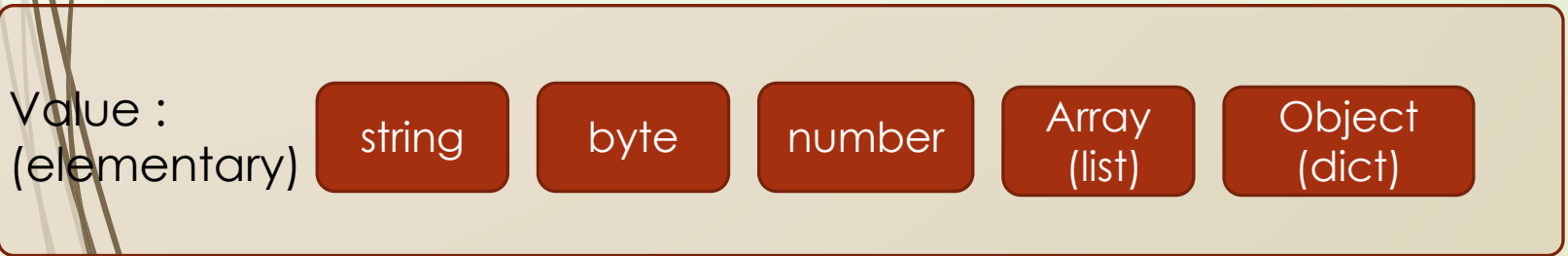**NameValue**
{ 'Paris' : [2,4, 48,9] }

Object
{'ilist': {'var': 25, 'idx': [
['datation','2021-01-01'],
['location', 'Paris'],
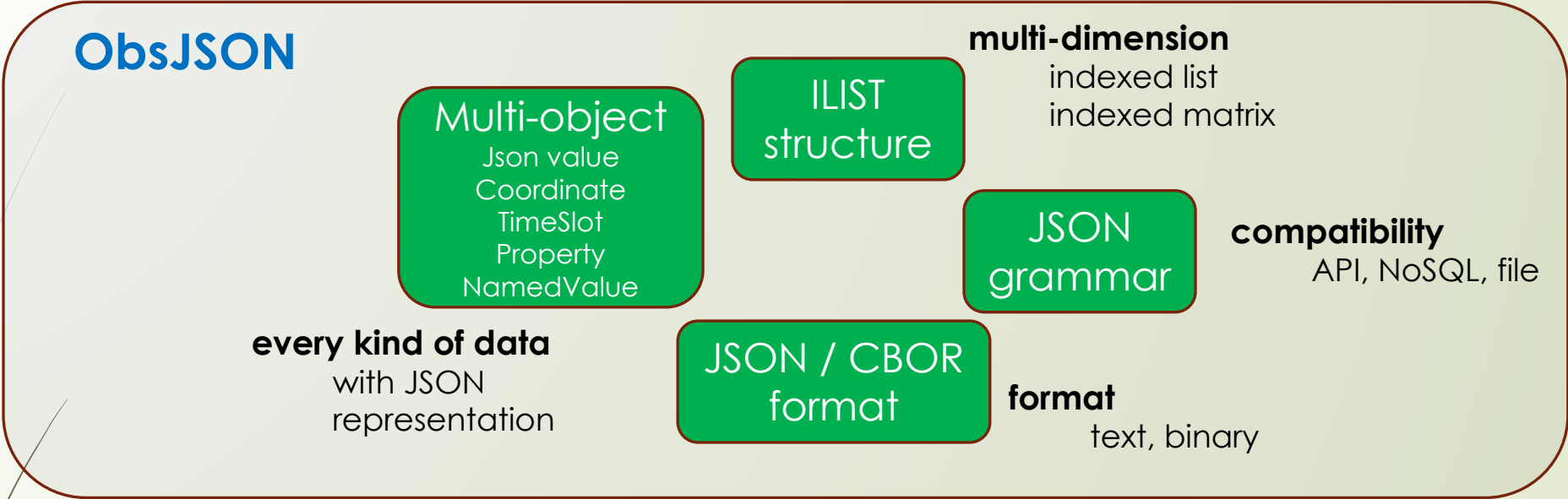['property', {'char':'PM10, 'unit': 'kg/m3'}]]}}

TimeSlot

[[[d1,d2]], [[d3,d4]]]
d1 d2 d3 d4

Property
{'char':'PM10, 'unit': 'kg/m3', …}

Characteristic
'char':'PM10 -> catalog
i.e. BLE characteristics

Confidential C

3 – Exchange format

ObsJSON

Multi-object
Json value
Coordinate
TimeSlot
Property
NamedValue

ILIST structure

multi-dimension
indexed list
indexed matrix

JSON grammar

compatibility
API, NoSQL, file

every kind of data
with JSON representation

JSON / CBOR format

format
text, binary

Example

{'data':
[['datation': ['2021-01-05']], ['location': [[2,4, 48,9]]], 'PM10', ['result': [51.3], -1]] }

01-05	[2,4, 48,9]	PM10	**51.3**

{'data': [
    ['datation', ['2021-01-05', '2021-01-15']],
    ['location', [{'Paris' : [2,4, 48,9] }, [4.8, 45.8], [5.4, 43.3]]],
    'PM10',
    ['result', [51.3, {'low': 2.4}, 20.8, 10, 50, 200]]}

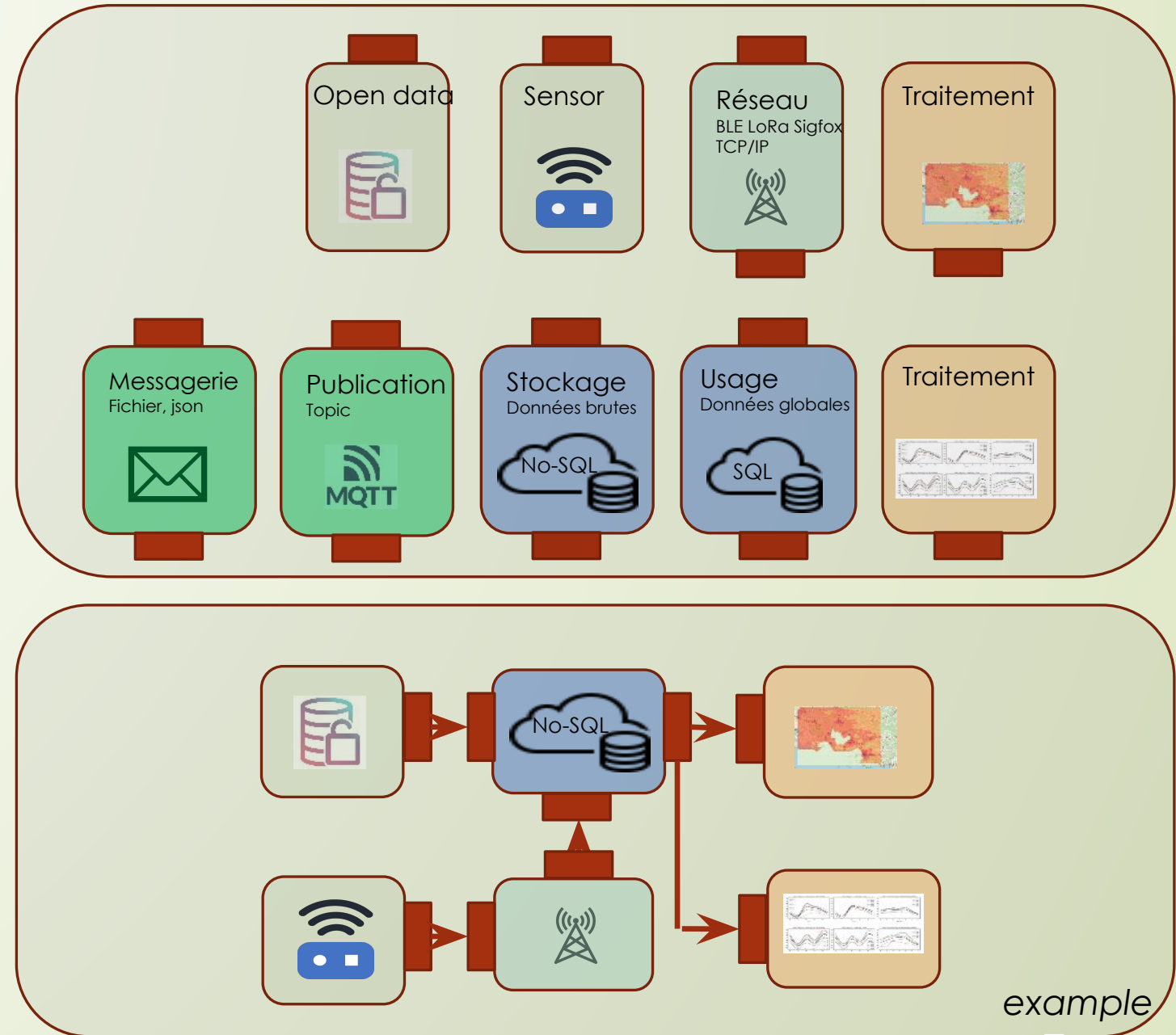| **PM10**	01-05	01-15
Paris [2,4, 48,9]	**51,3**	**10**
[4.8, 45.8]	**2,4**	**50**
[5.4, 43.3]	**20,8**	**200**

4 - Connectors

> ## Connectors library

- Library of connectors across the entire data lifecycle
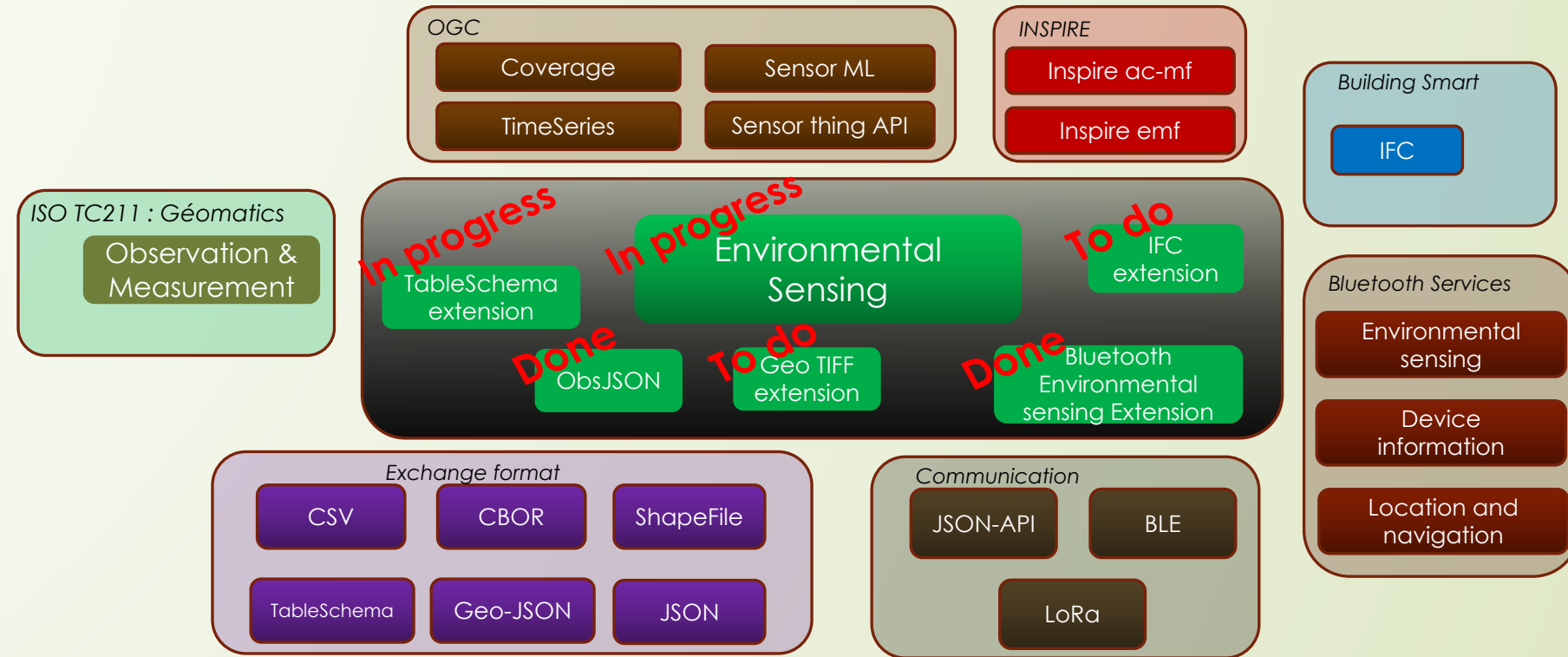
- Adjustable

> ## Connectors assembly

- Inter-connections

- Application integration

example

5 - Convergence of standards

☐ Numerous standardization / structuring works

☐ Disjoint domains

☐ convergence of standards rather than new standards

OGC
- Coverage
- Sensor ML
- TimeSeries
- Sensor thing API

INSPIRE
- Inspire ac-mf
- Inspire emf

Building Smart
- IFC

ISO TC211 : Géomatics
- Observation & Measurement

In progress — TableSchema extension

In progress — **Environmental Sensing**

To do — IFC extension

Done — ObsJSON

To do — Geo TIFF extension

Done — Bluetooth Environmental sensing Extension

Bluetooth Services
- Environmental sensing
- Device information
- Location and navigation

Exchange format
- CSV
- CBOR
- ShapeFile
- TableSchema
- Geo-JSON
- JSON

Communication
- JSON-API
- BLE
- LoRa

Orientations

☐ A common structure : Environmental sensing structure

☐ StaNdards extensions : Bluetooth, ObsJSON, TableSchema, GeoTIFF, IFC

Appendix

Concepts and principles

Detailed presentation

Observation - structure

> Ilist derived class

- -> *see Ilist presentation*
- New attributes : Name, Id, parameters
- Extensions : BoundingBox, format ObsJSON

> Predefined indexes

- Datation : DatationValue
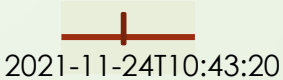- Location : LocationValue
- Property : PropertyValue
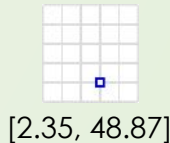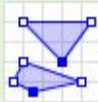- Result : Variable

> New methods

- Visualization
- filtering, sorting
- Interface DataBase

> Predefined structure

- Dimension
- use case (eg Multiple measures, Mobile sensors, grid measurements, Tracking, Model results)
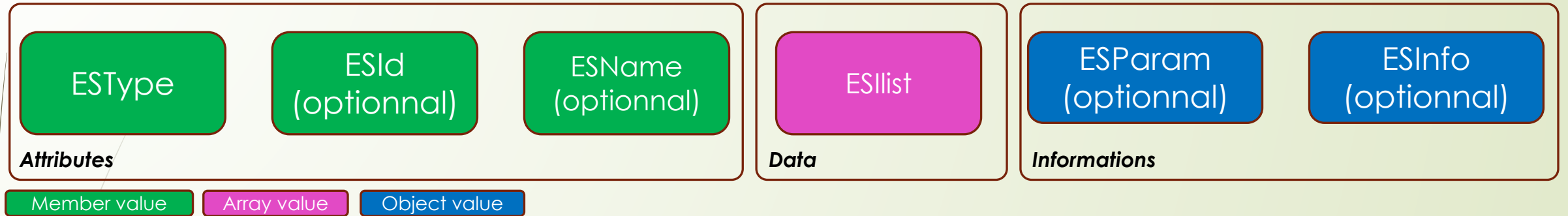
Implémentation : datation, location, property, result

	Datation	Location	Property	Result
Textual	« morning »	« Paris »	« Air pollutant »	«High»
Simplified	2021-11-24T10:43:20	[2.35, 48.87]	type : PM25 Unit : µg/m3	25
Detailed	d1 d2 d3 d4 [[[d1,d2], [[d3,d4]]]	[[[[30,20],[45,40],[10,40],[30,20]]], [[[15,5],[40,10],[10,20],[5,10],[15,5]]]]	type : PM25 Unit : µg/m3 Sampling : instantaneous Period : 600 Uncertainty : 10%	Anything

Common properties

Boundary	:	min – max
Conversion	:	detailed -> simplified
Representation	:	json , binary

Specific properties

Location	:	Open Location Code (e.g. 8F W4 V7 5V + 8F)
Datation	:	Year, Month, Day, Weekday…
Property	:	Catalog classification
Result	:	Conversion to float

ObsJSON

Attributes			Data	Informations	
ESType	ESId (optionnal)	ESName (optionnal)	ESIlist	ESParam (optionnal)	ESInfo (optionnal)

Member value — Array value — Object value

ESType: "type": "obs"
ESId: "id": "ob12345"
ESName: "name": "observation initiale"

ESIlist: "data": JSON Array

ESParam: "param": JSON Object
ESInfo: "infos": JSON Array

Format
Text (JSON text), Binary (CBOR)

Examples

{'type': 'obs', 'data': ['Anne' 'John', 'Paul']}

{'type': 'obs', 'id': 'ob12345', 'name': 'obs init',
 'data': [
        ['datation', ['2021-01-04',[['2021-01-05','2021-01-05']]]],
        ['location', [[2.4, 48.9], [[[2.4, 48.9], [4.8, 45.8], [5.4, 43.3]]]], 0],
        ['property', [{'prp': 'PM10', 'unit': 'μg/m3'}, {'prp': 'Temp'}]]
        ['result', [51.3, {'low temp': 2.4}, 20.8, 'high temp'], -1]
        ],
 'param': {'pdict': 'official', 'example':4},
 'infos': {'locbox': [2.4, 48.9], 'dim': 2
}