

# Spécification NGSI-LD

&

# Communauté FIWARE

Franck Le Gall, 19<sup>th</sup> June 2024



# APPROCHE GÉNÉRALE



Déploiement de  
solutions ouvertes  
d'aide à la décision

Solutions ouvertes  
=  
open-source +  
normalisation ETSI

## PLATEFORME TERRITORIALE DE DONNÉES





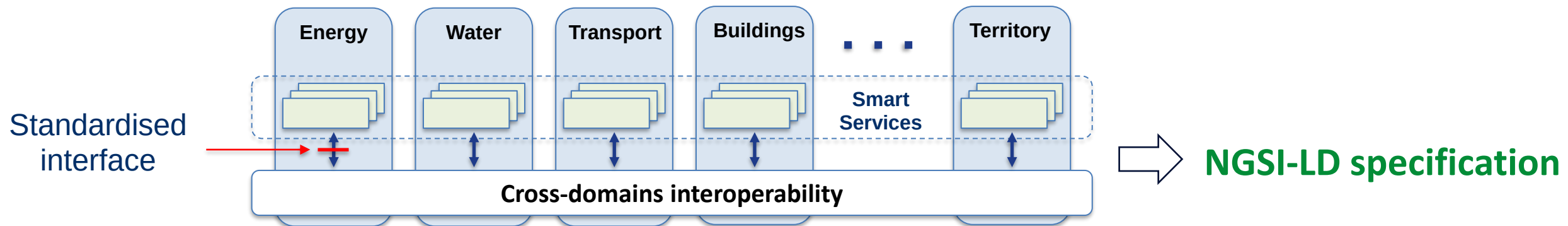
# INTRODUCTION À FIWARE / NGSI-LD



# SHARING CONTEXTUALIZED INFORMATION STIMULATES INNOVATION AND THE DATA ECONOMY



- Organizations in different domains can exchange data based on a common contextual information management layer
- Authorization and access control policies govern who can access what and when (data sovereignty)
- Organizations can monetize the data they offer (data economy)



# LA SPÉCIFICATION NGSI-LD



- Une spécification créée par l'ETSI, en évolution constante

Un modèle de données “cross-domain” pour favoriser l’interopérabilité

- Basé sur un graphe Entity - Property – Relationship
- Permet de définir un langage commun



Une API RESTful pour gérer et interagir avec le contexte d’information

- HTTP (... + MQTT, websocket, DDS) / JSON-LD

- Version 1.8.1 publiée, version 1.9.1 en rédaction
  - Contributeurs : NEC, Fondation FIWARE, CNIT, EGM, ...
- Plus d’informations : <https://www.etsi.org/committee/cim>

# L'API NGSI-LD

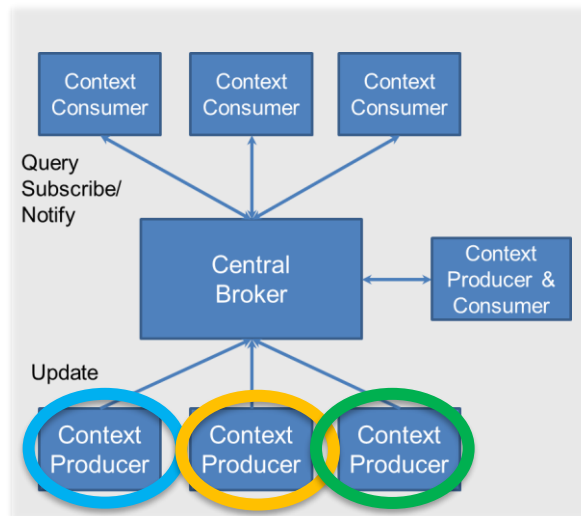
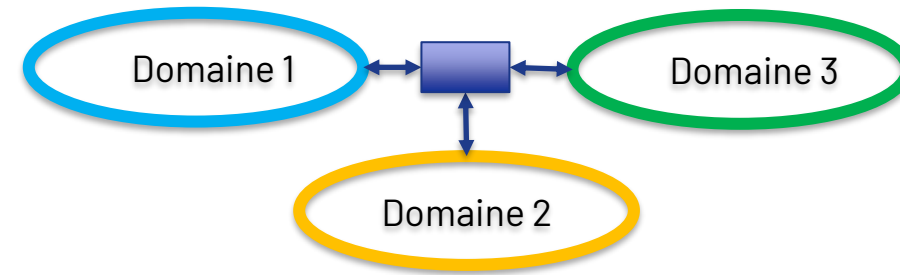
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## Couverture fonctionnelle :

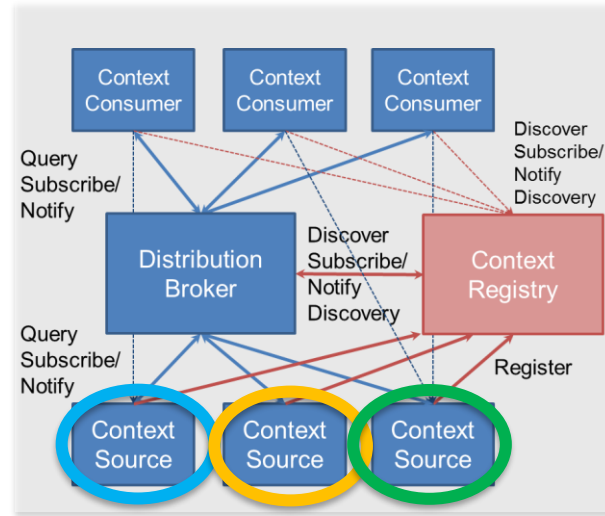
- Gestion du contexte d'informations
  - CRUD
  - Opérations “batch”
  - Opérations “discovery”
- Requêtes temporelles et géospatiales
- Abonnements et notifications
- Gestion de sources d'informations (dans un context de fédération ou distribution)

# L'API NGSI-LD : CONTEXTES DE DÉPLOIEMENT

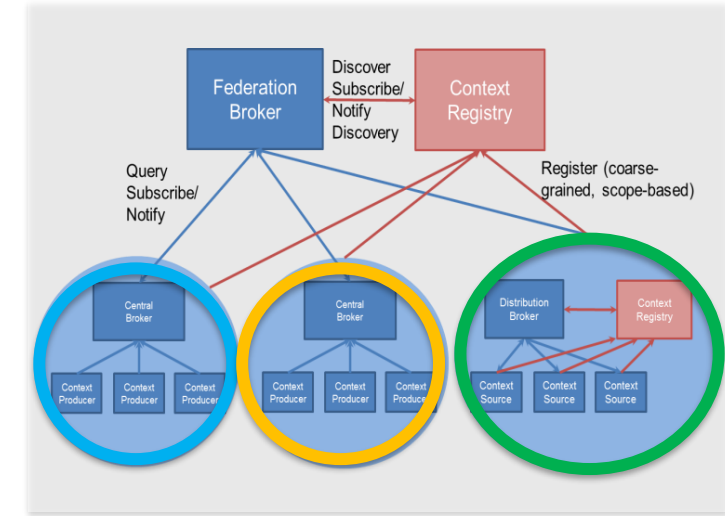
+ Scopes  
+ Tenants



Centralisé

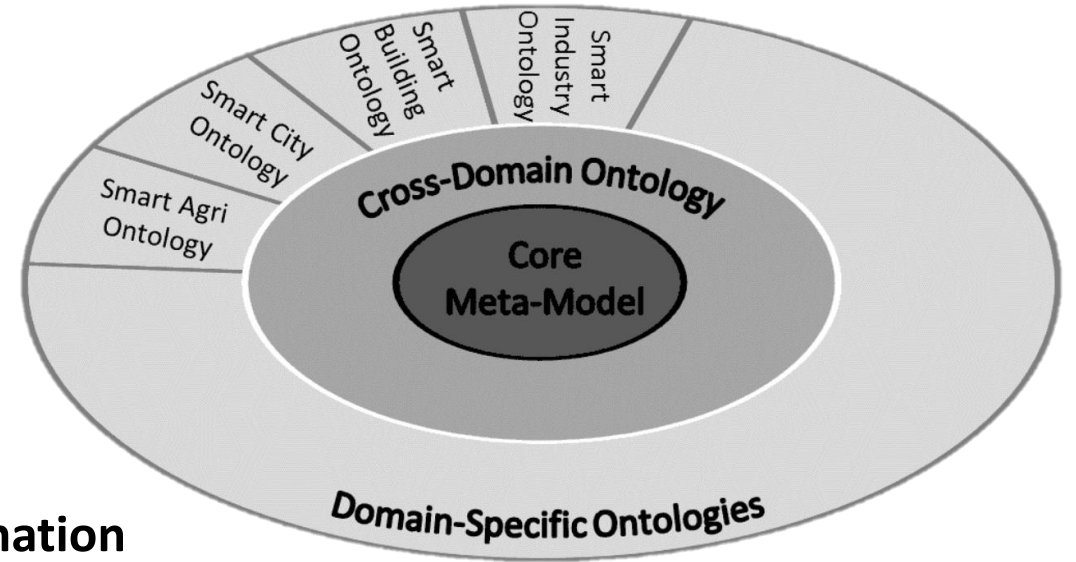


Distribué



Fédéré

# LES MODÈLES DE DONNÉES



**Cross-Domain, core properties for giving context to your information are defined in a mandatory way, to be used by API operations (e.g. geo queries)**

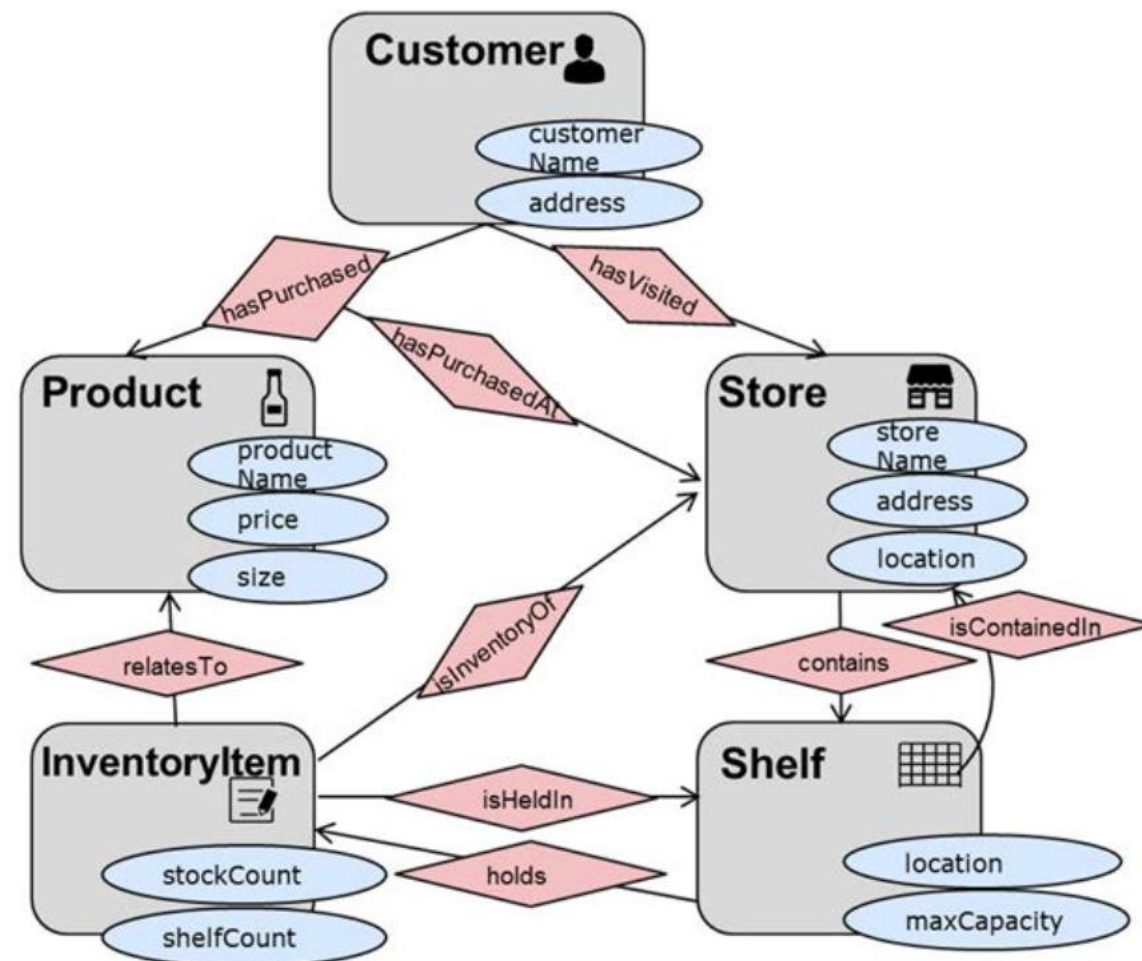
- *location* → Geospatial location, encoded as GeoJSON.
- *observedAt* → Observation timestamp, encoded as ISO8601. (timestamp)
- *createdAt* → Creation timestamp (of entity, attribute).
- *modifiedAt* → Update timestamp (of entity, attribute).
- *unitCode* → Units of measurement, encoded as mandated by UN/CEFACT.



# Example Data Model: Grocery store



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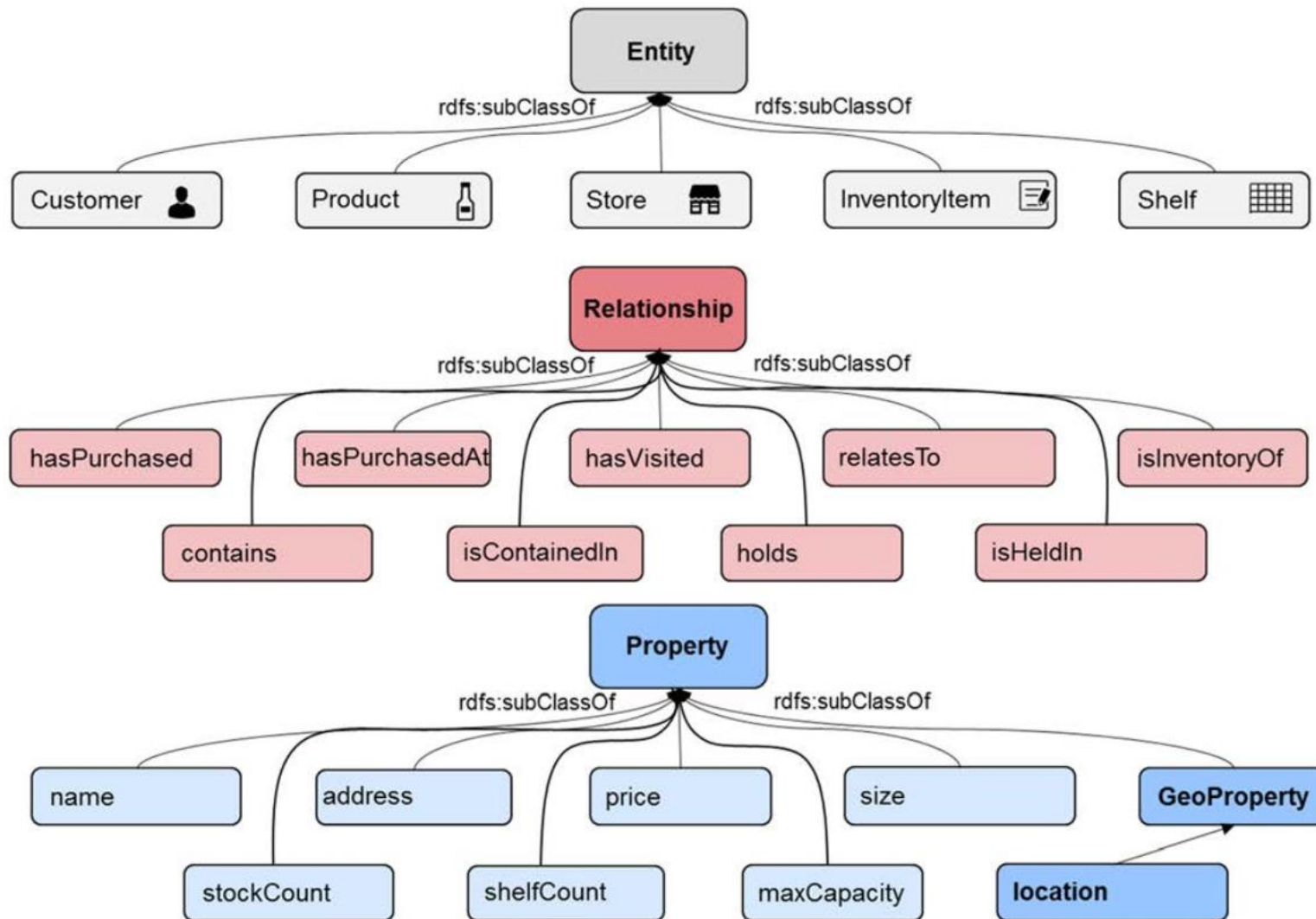


All clipart is under [Creative Commons BY 4.0](https://www.creativecommons.org/licenses/by/4.0/) Licence from <https://www.svgrepo.com>

[https://www.etsi.org/deliver/etsi\\_gr/CIM/001\\_099/008/01.02.01\\_60/gr\\_CIM008v010201p.pdf](https://www.etsi.org/deliver/etsi_gr/CIM/001_099/008/01.02.01_60/gr_CIM008v010201p.pdf)

Introduction NGSI-LD et écosystème FIWARE

# Information Model



GET /ngsi-ld/v1/entities/urn:ngsi-ld:Store:001

```

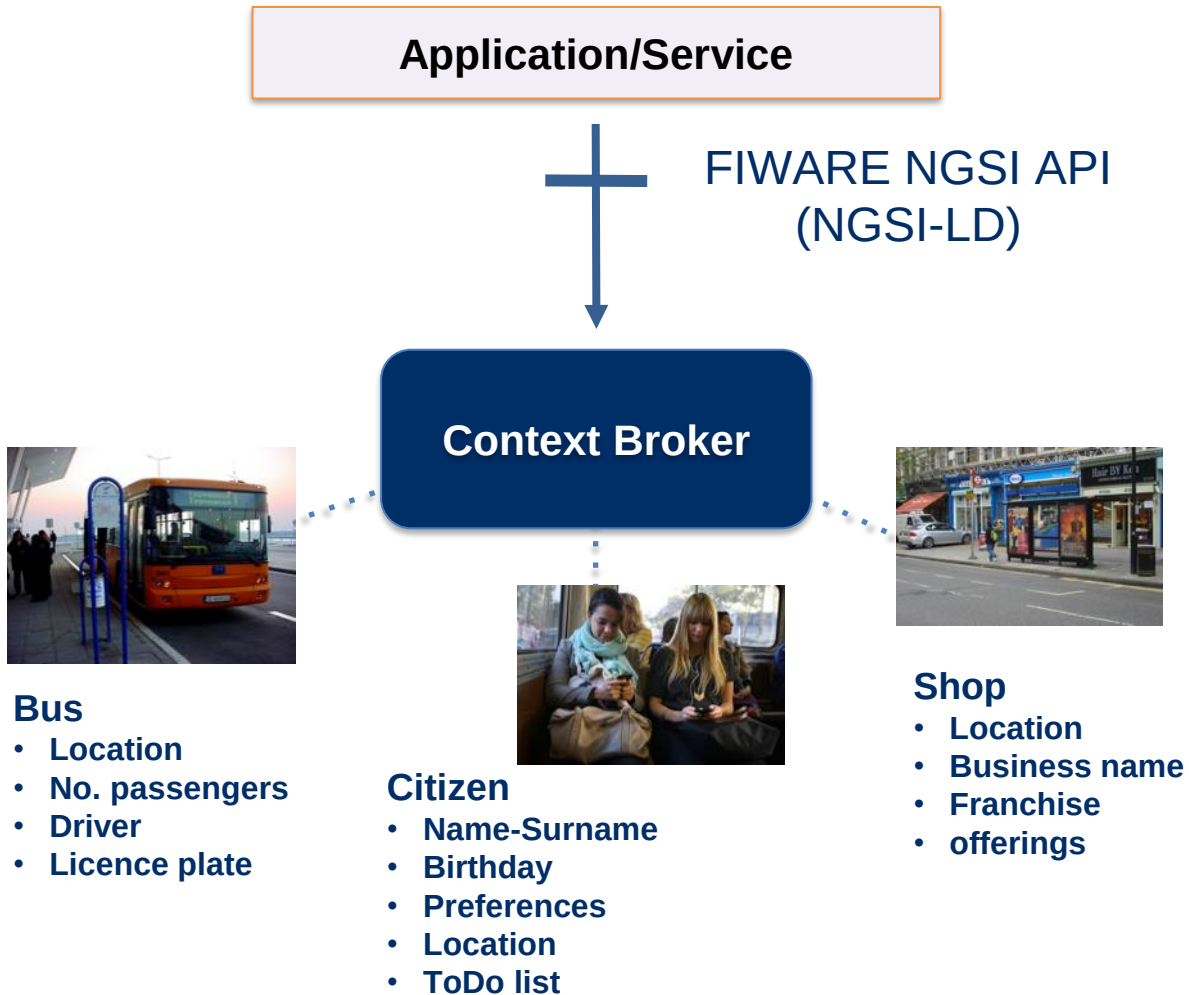
{
  "id": "urn:ngsi-ld:Store:001",
  "type": "ngsi-ld:primer/Store",
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [ 57.4874121, -
        20.2845607 ]
    }
  },
  "ngsi-ld:primer/storeName": {
    "type": "Property",
    "value": "Checker Market"
  },
  ...

  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld" ]
}

```

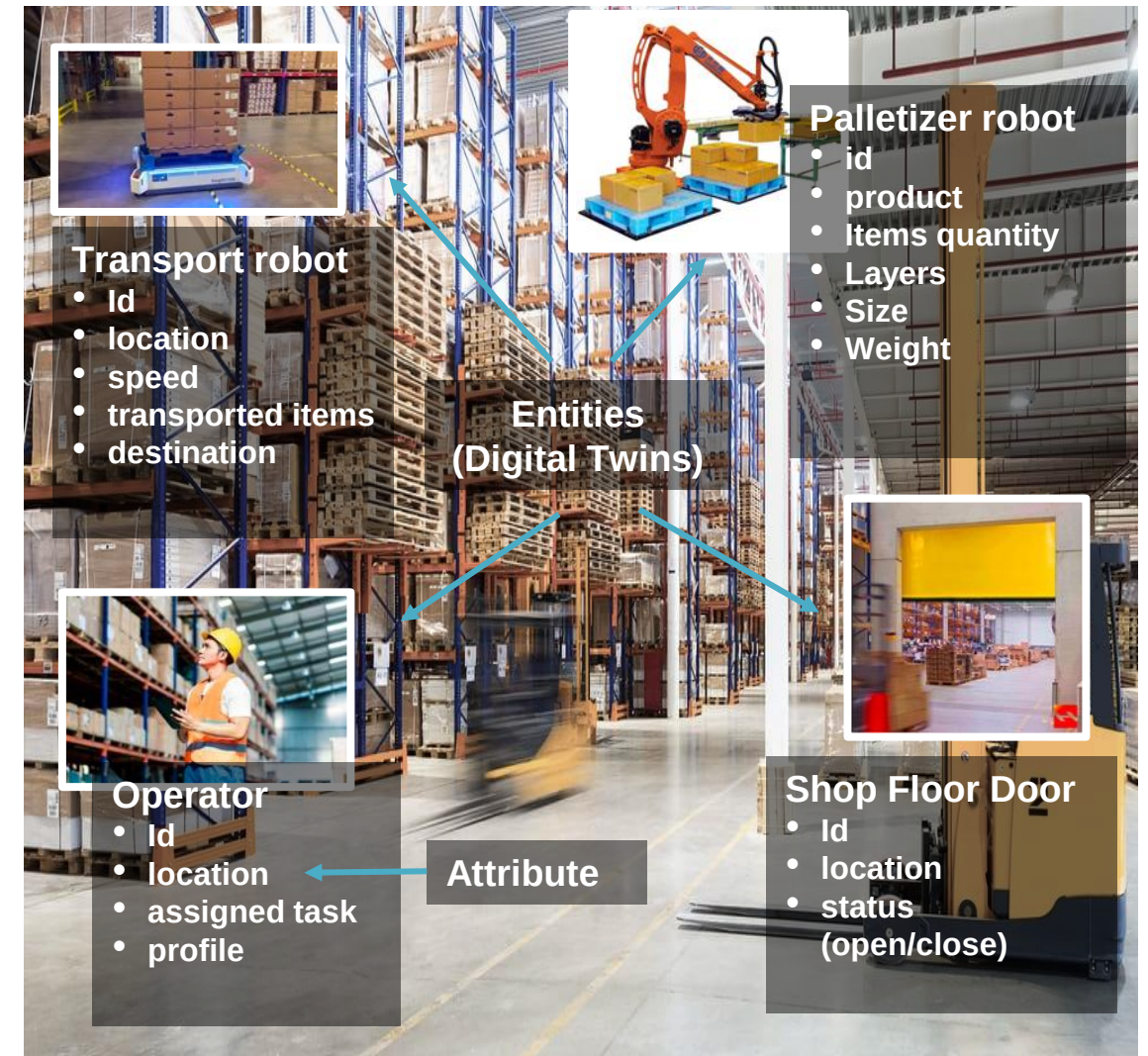
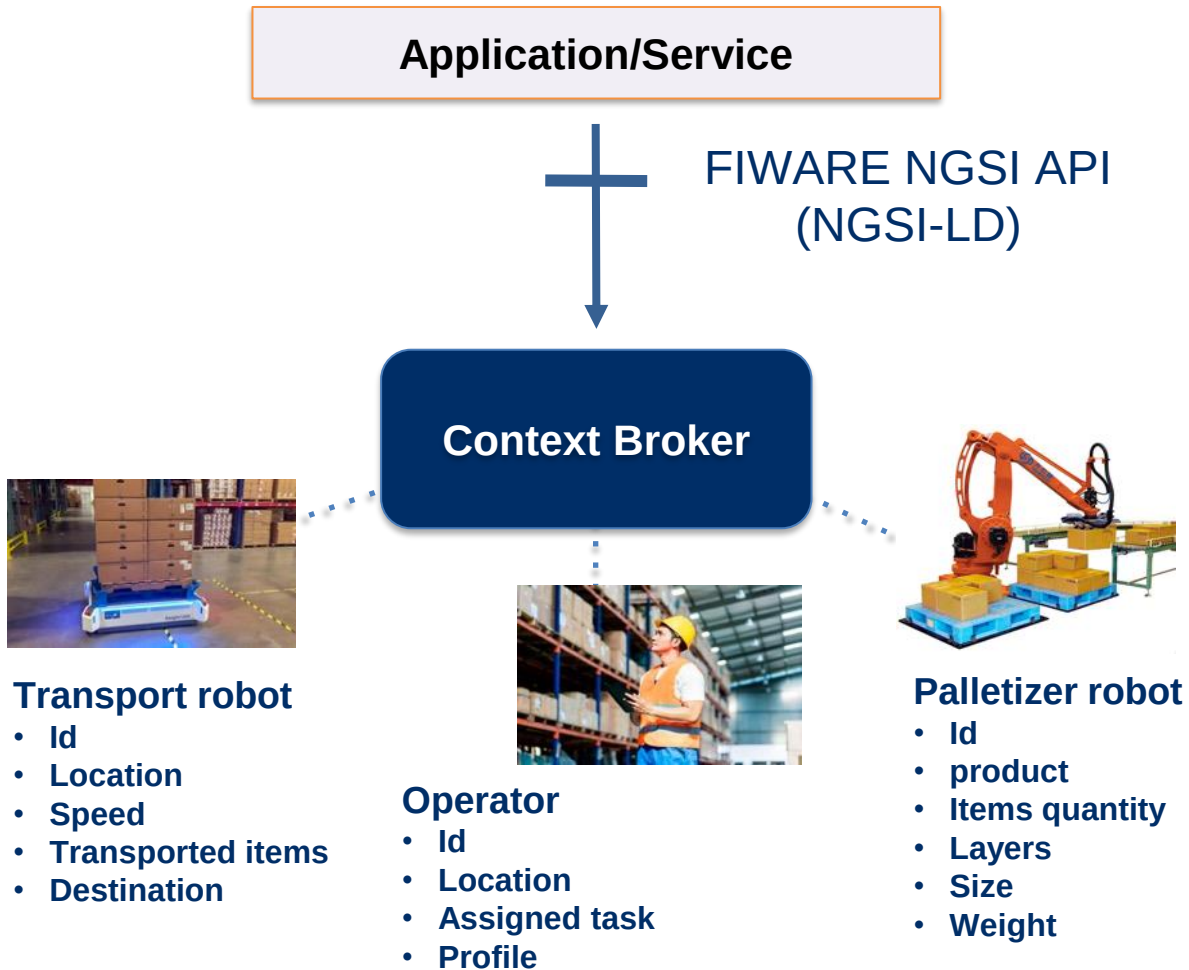


# Data Exchange API: ETSI NGSI-LD



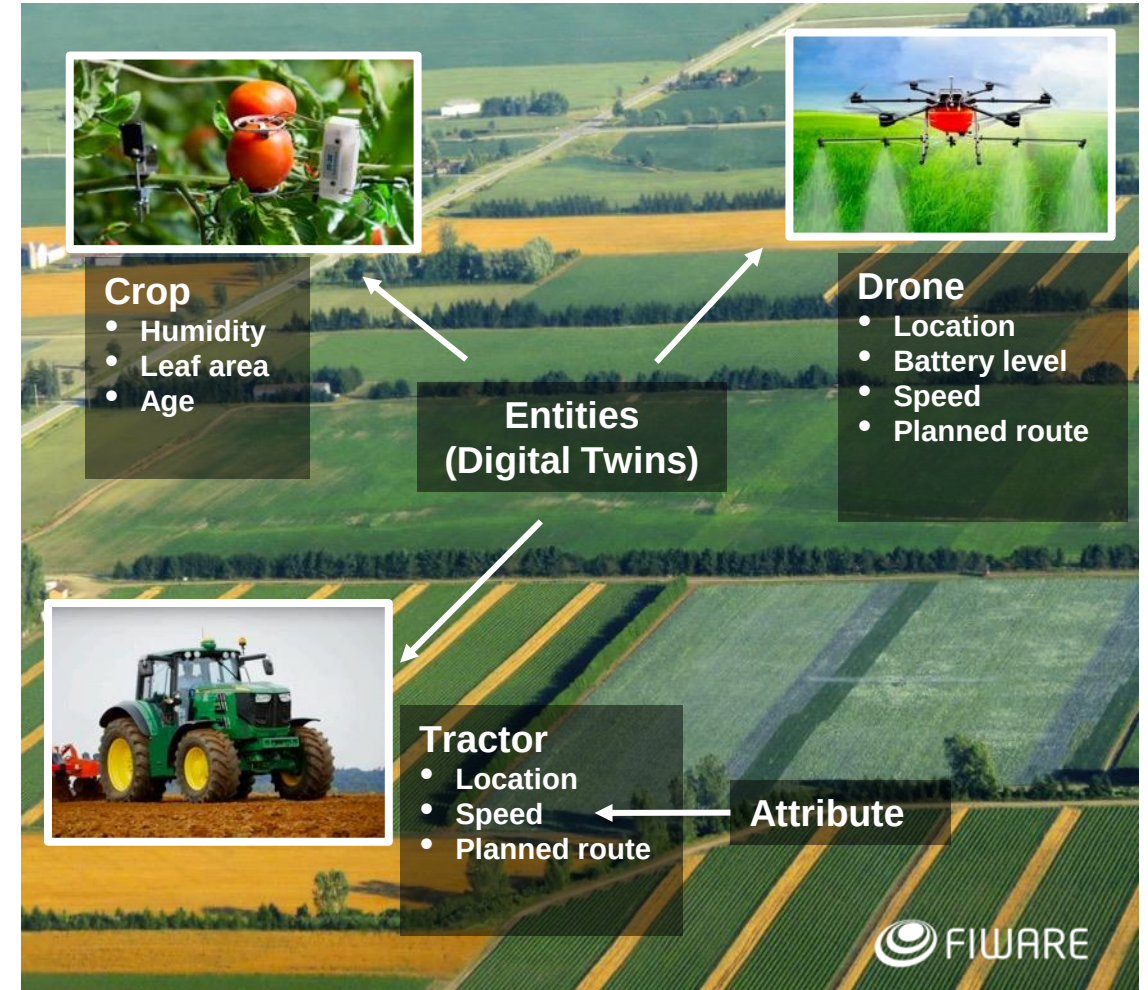
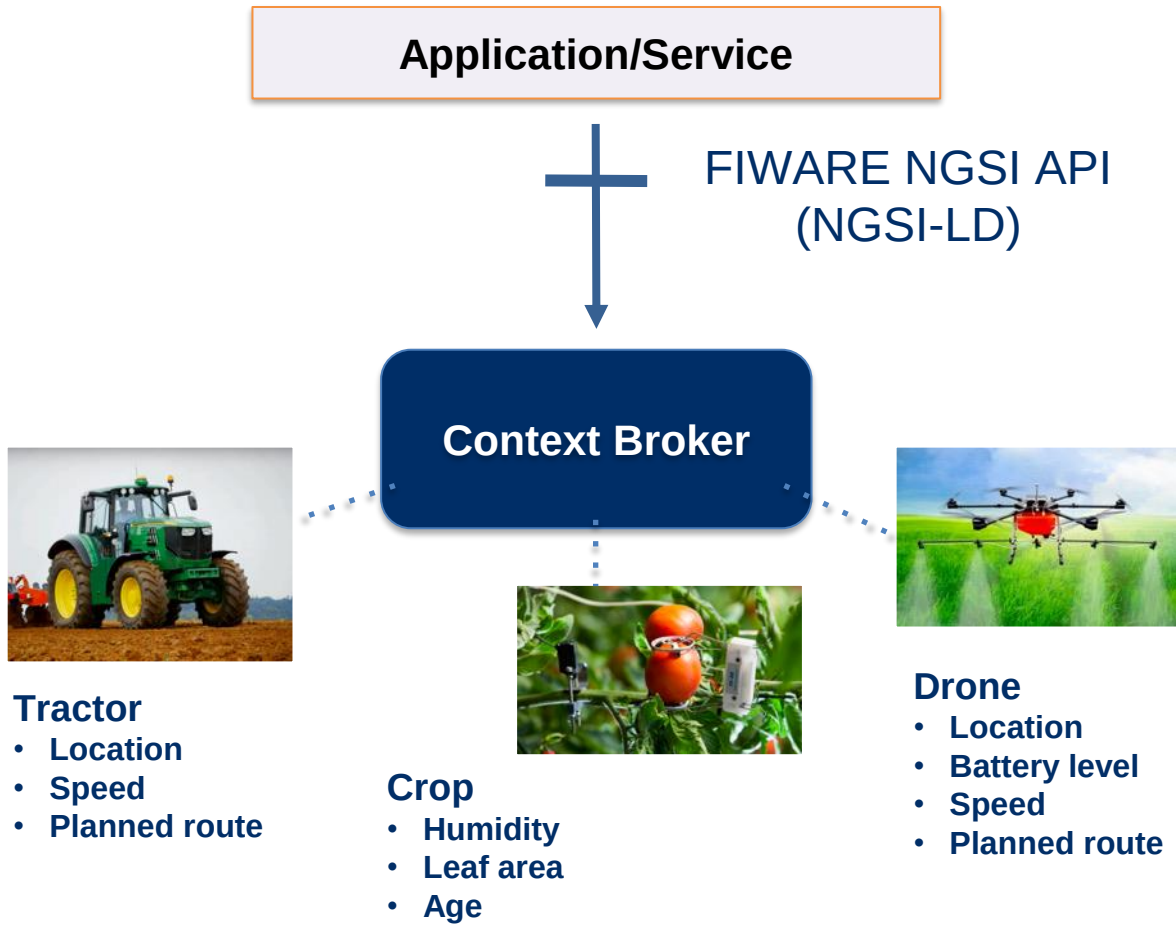


# Data Exchange API: ETSI NGSI-LD





# Data Exchange API: ETSI NGSI-LD



# Data Exchange API: ETSI NGSI-LD

Application/Service



FIWARE NGSI API  
(NGSI-LD)

Context Broker



**Ambulance**

- license plate
- location
- speed
- equipment
- current alert



**Alert**

- alert id
- emergency level
- description
- location
- patient id



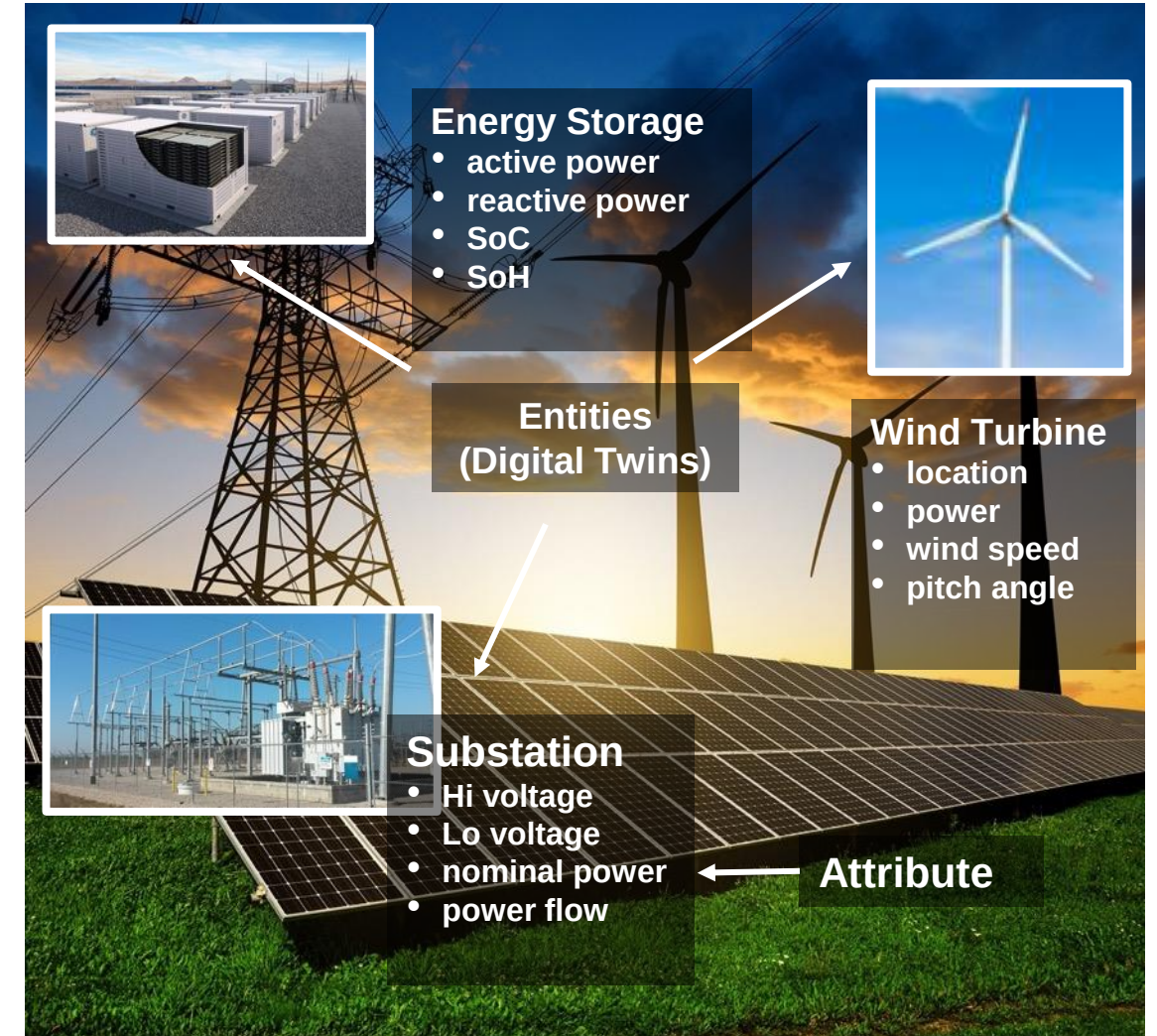
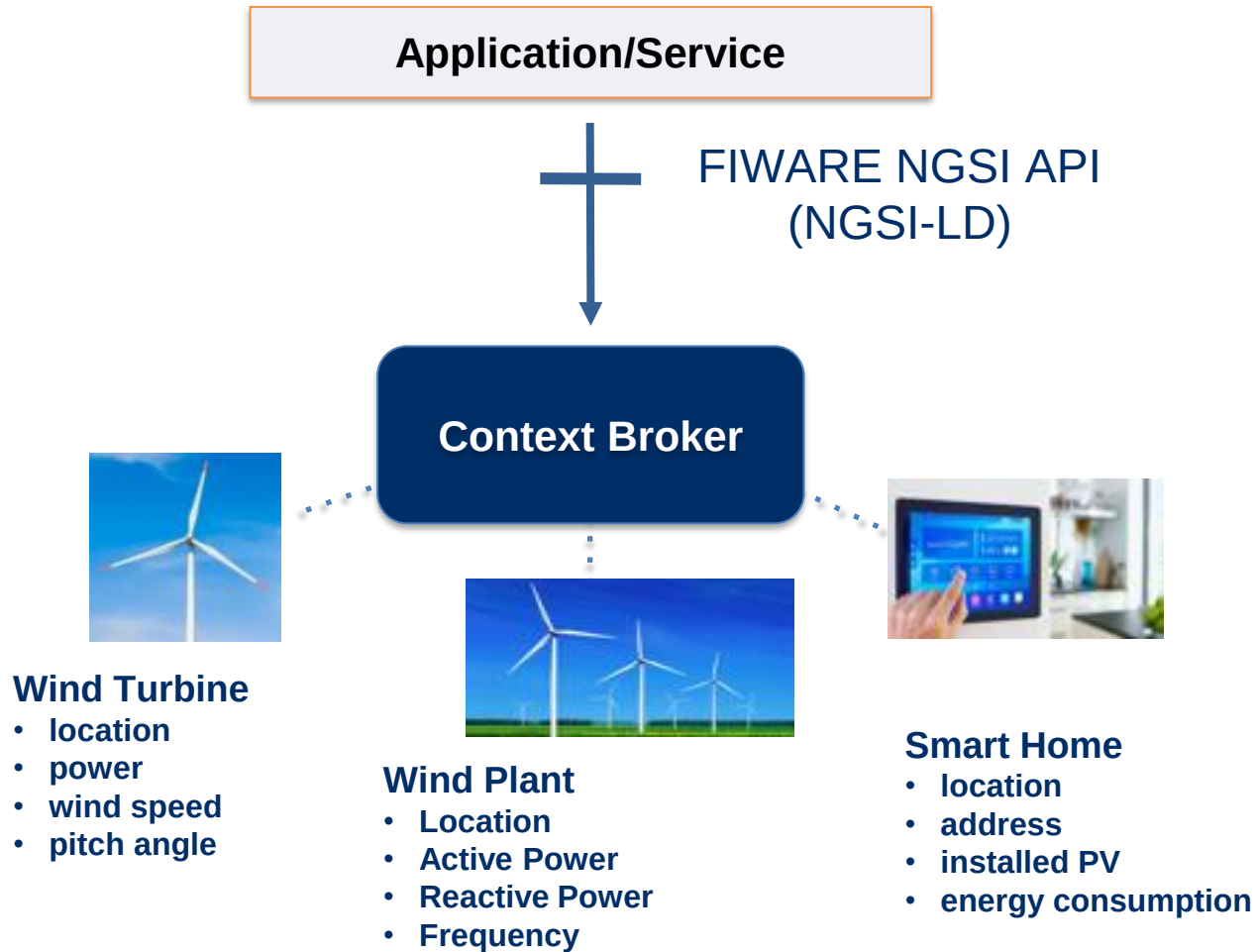
**Surgery Room**

- id
- hospital
- equipment
- surgery plan





# Data Exchange API: ETSI NGSI-LD







## NGSI-LD QUERY & SUBSCRIPTION LANGUAGE

Note: check the [PRIMER](#) for a user oriented description of the API



# Information Provision

## Query by id

- GET /entities/urn:ngsi-ld:OffStreetParking:ABCDE
- GET /entities?id=urn:ngsi-ld:OffStreetParking:AB23E&type=OffStreetParking

## Query by list of IDs

- GET /entities?id=urn:ngsi-ld:OffStreetParking:AB23E,  
urn:ngsi-ld:OffStreetParking:FF11AA&type=OffStreetParking

## Query by type

- GET /entities?type=OffStreetParking

## Query by list of types

- GET /entities?type=OffStreetParking,OnStreetParking

# Queries with restrictions

## Query entities that match restrictions (logical “and” using ‘;’ )

- GET /entities?q=<Expression>; <Expression> ....

## Restrictions on Values and on data types (Text, Number, DateTime...)

- Equal → brandName==Mercedes
- Equal with multiple alternatives → brandName==Mercedes,Audi
- Unequal → brandName!=Mercedes
- Greater than → temperature>20;temperature>=20
- Less than → temperature<10;temperature<=10
- Match pattern → brandName~=cedes\$
- Match range (closed interval) → temperature==10..20



# Queries by structured properties

## Queries over Structured Values

- `GET /entities?type=Building&q=address[street]==Franklinstrasse`

## Specific attributes can be requested

- `GET /entities?type=Room&q=temperature>20&attrs=temperature,capacity`

# Queries by location

**List entities located at a certain threshold distance to a reference geometry.**

- `/entities?georel=near;maxDistance==2000&geometry=point&coordinates=[-2.35, 40.78]`

**List entities that exist entirely within a reference geometry.**

- `/entities?georel=coveredBy&geometry=polygon&coordinates=[[[[-80.190,25.774],[-66.118,18.466],[-64.757,32.321],[-80.190, 25.774]]]]`
- **georel** → (near, coveredBy, intersects, equals, disjoint)
- **geometry** → (point, bbox, polygon, line)
- **coordinates** → as per GeoJSON

# Temporal queries

## Aggregation functions over time series

- *totalCount*
- *distinctCount*
- *sum*
- *avg*
- *min*
- *max*
- *stddev*
- *Sumsq*

## Can be mixed with geo queries

“Get average temperature over last month on that area”

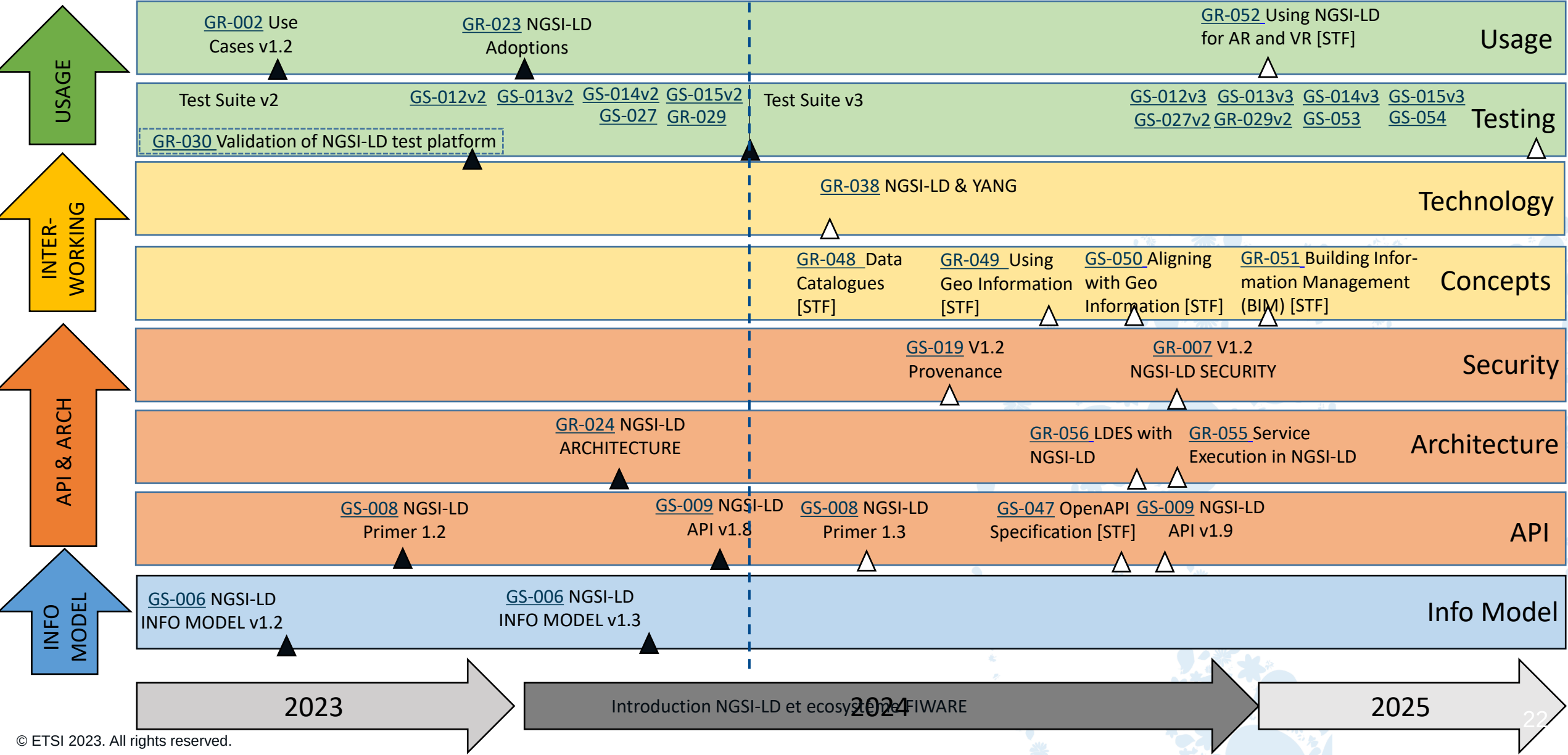
```
{
  "id": "urn:ngsi-ld:Wine:001",
  "type": "Wine",
  "price": {
    "type": "Property",
    "value": 7.83,
    "observedAt": "2021-04-04T11:40:00.000000Z"
  },
  "quantity": {
    "type": "Property",
    "value": 20,
    "observedAt": "2021-04-04T11:40:00.000000Z"
  },
  "putBackOnShelf": {
    "type": "Relationship",
    "object": "urn:ngsi-ld:Shelf:234",
    "observedAt": "2021-04-04T11:40:00.000000Z"
  }
}
```



# Roadmap for NGSI-LD

▲ publishing date

△ expected publishing date

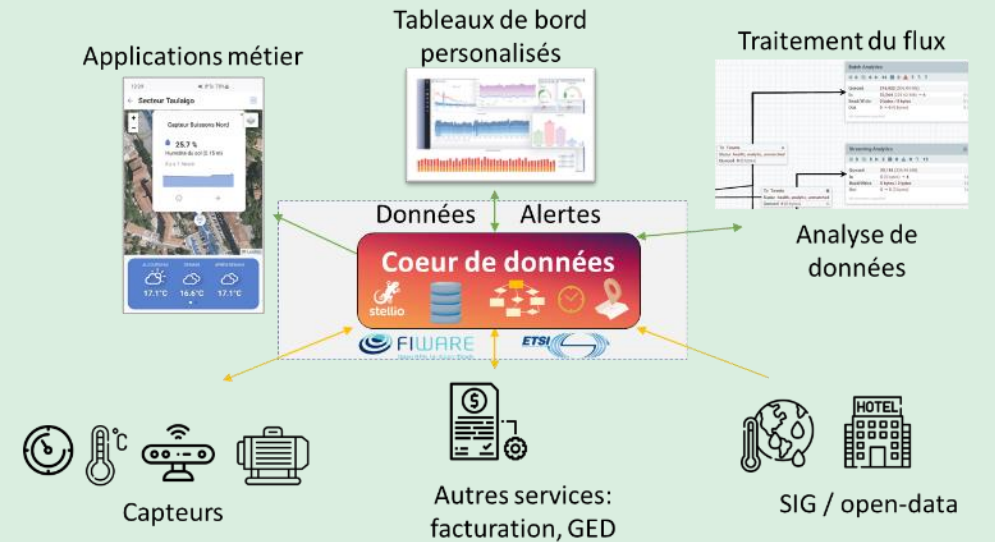


# L'écosystème FIWARE



**+600** membres proposent actuellement des services au sein de FIWARE MARKET PLACE

**+250** villes dans **30** pays utilisent FIWARE

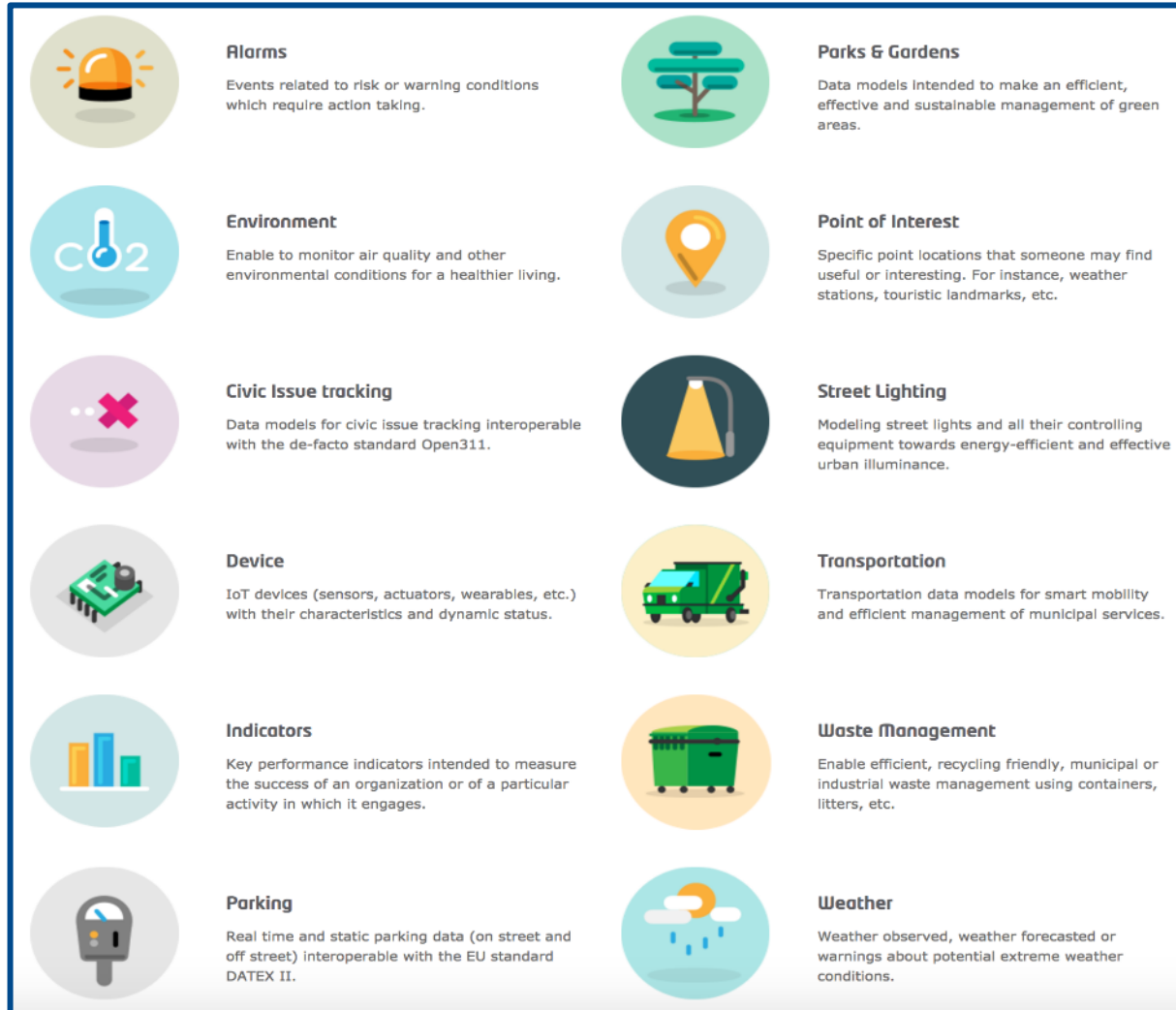


FIWARE est un **écosystème**, basé sur la **norme NGSI-LD**, qui intègre un catalogue de briques technologiques **open-source** basées sur une norme européenne



Les territoires européens peuvent ainsi créer des solutions sur mesure tout en profitant de la répliquabilité de l'existant

# Smartdatamodels.org : partage de modèles de données



- Plateforme collaborative de partage de de modèles de données NGSI-LD
- Contribué par la donnée, qualifié par FIWARE
- Source d'inspiration pour mise en place de nouveaux déploiements
- Interopérabilité facilitée

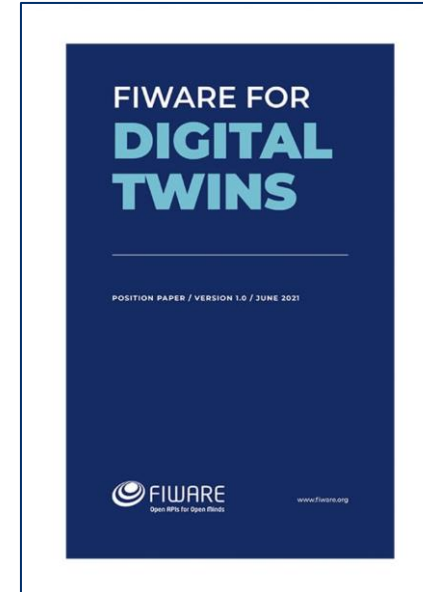


<https://smartdatamodels.org/>

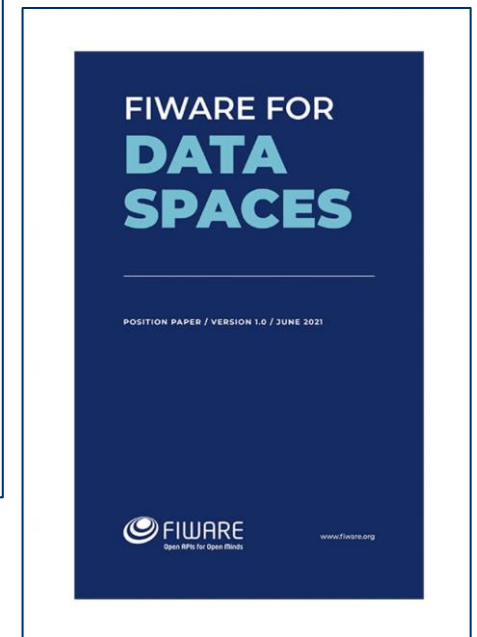
# FIWARE: a living framework with a comprehensive roadmap

- **Digital Twin** → Consolidate NGSI-LD as reference standard
  - Implementation-driven standardization of advanced features
  - Integration with VR and AR frameworks
  - basis for integration of robotic systems (e.g., agile production)
- **Data Spaces** → First open source framework implementing DSBA technology convergence results
  - Integration with EBSI-compliant Trust Anchor Frameworks
  - Decentralized IAM based on W3C DID - VC/VP standards - support to SIOPv2, OIDC4VP protocols
  - Implementation of Shared Catalogue and Marketplace functions aligning TM Forum and Gaia-X specifications
- **Blockchain / DLTs** → Support to audits and forensics
  - Zero-code integration with Blockchain/DLTs: Canis Major
  - Integration with multiple DLTs
- **AI/ML** → enabling reusable “plug&play” AI/ML services:
  - Standard architecture enabling “AI/ML as a service”
  - Support to MLOps concepts

Get your copy [here](#)



Get your copy [here](#)



Want to contribute?  
Write to: [CTO-team@fiware.org](mailto:CTO-team@fiware.org)

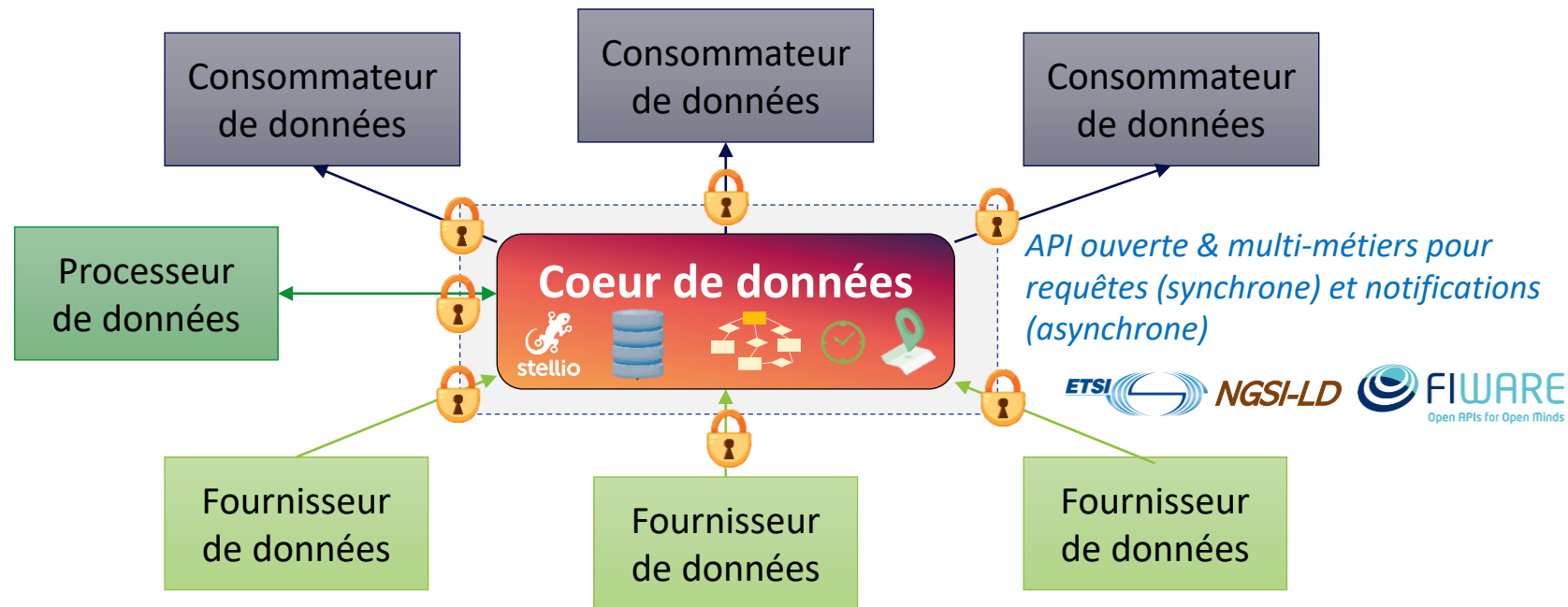


# ARCHITECTURE STELLIO/FIWARE

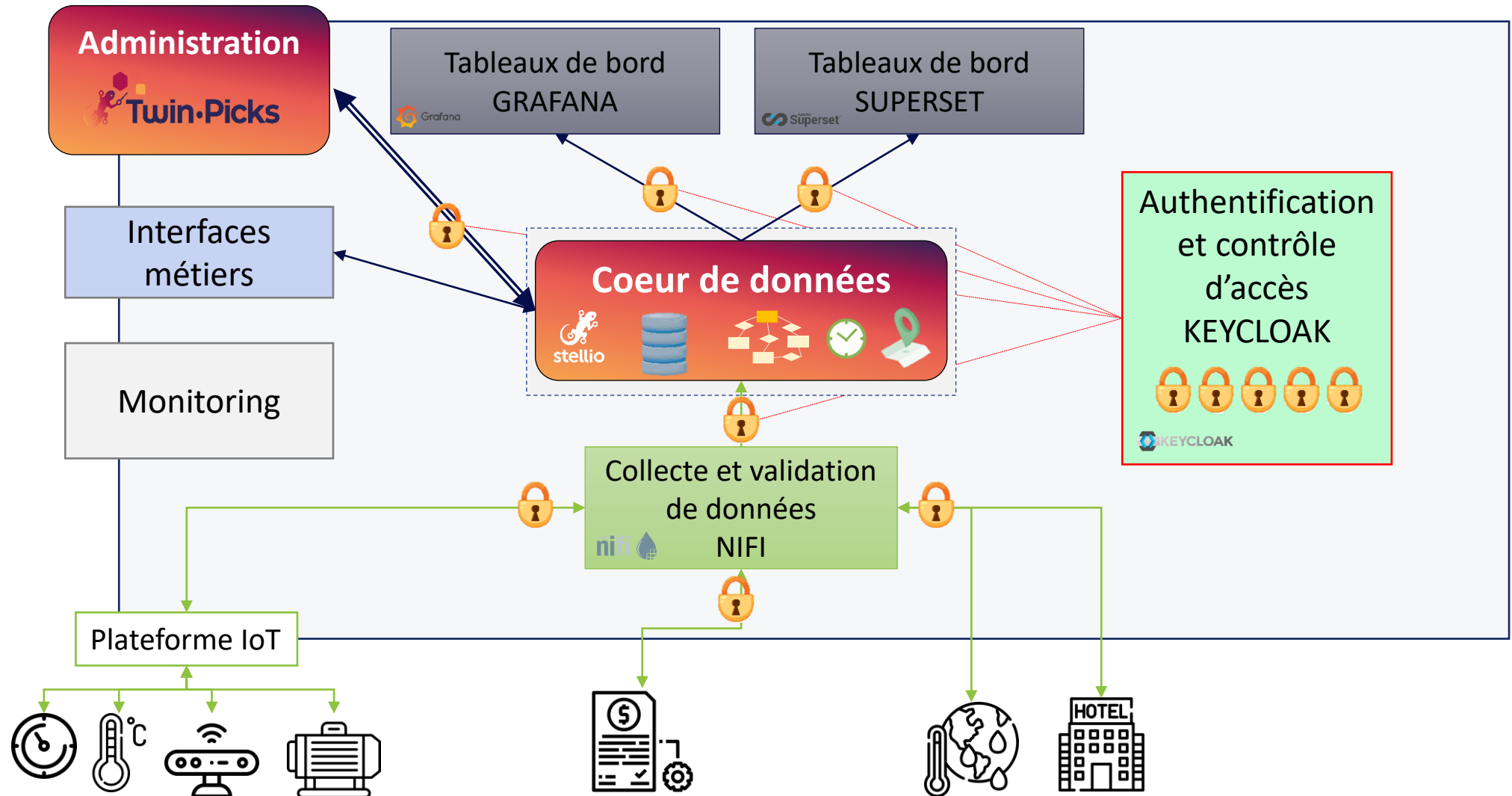


# ARCHITECTURE FIWARE STANDARD

## Données contextualisée espace / temps / relations

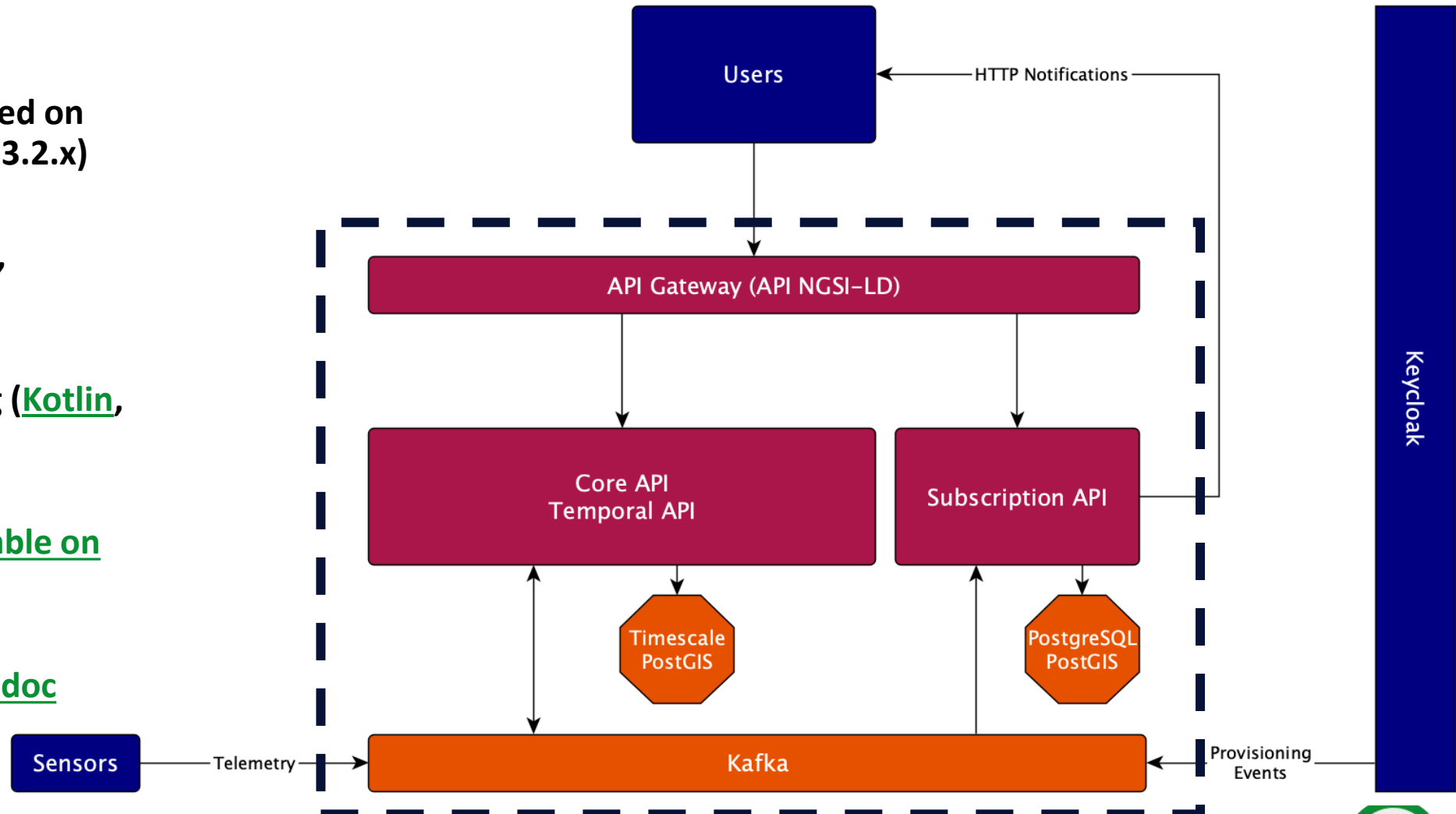


# MISE EN ŒUVRE TYPIQUE



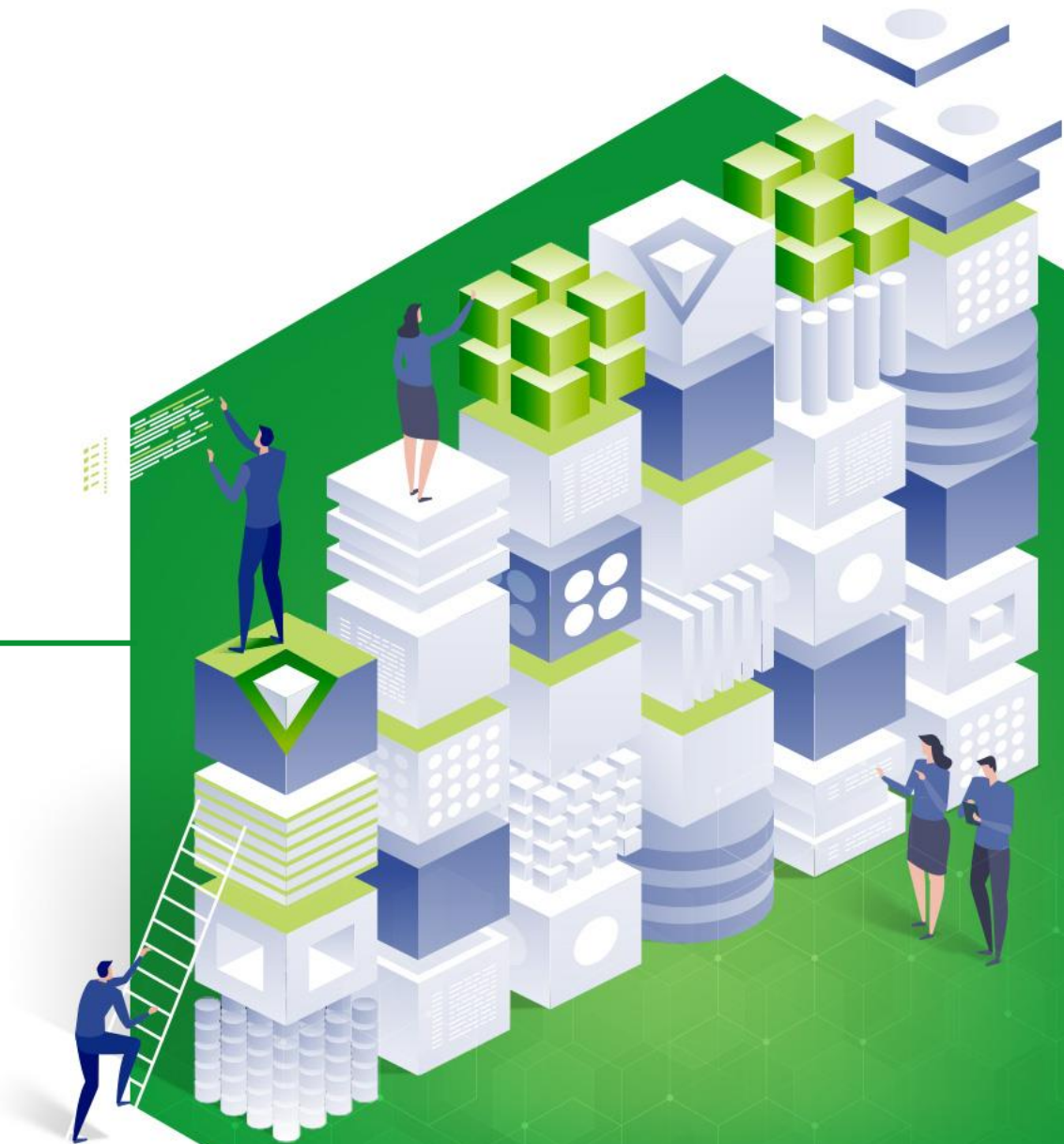
# CŒUR DE DONNÉES STELLIO

- Developed in [Kotlin](#), based on [Spring Boot](#) framework (3.2.x)
- Reactive stack ([WebFlux](#), [Coroutines](#), [R2dbc](#))
- Functional programming ([Kotlin](#), [Arrow](#))
- Fully open-source, [available on GitHub](#)
- Documented on [readthedoc](#)





# EXEMPLES DE DÉPLOIEMENTS

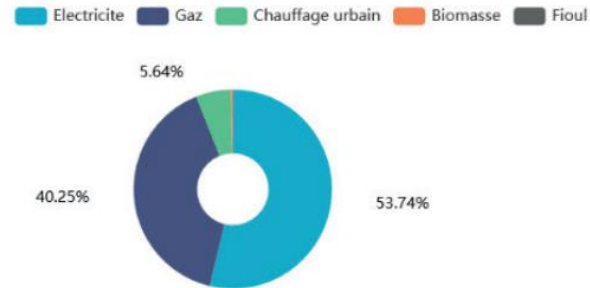


# SUIVI FLUIDES - ENERGIE

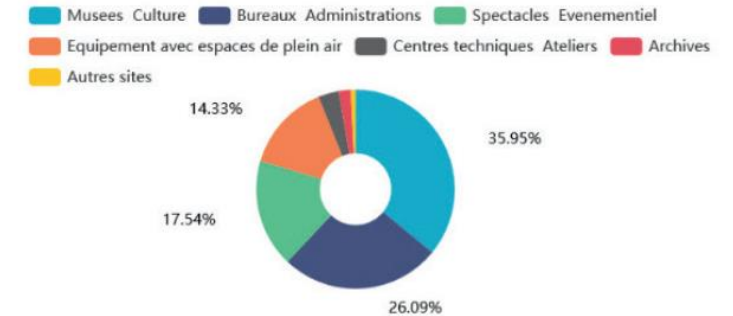


- Suivi de consommation et de facturation
- Plateforme multi-acteurs, multi-fluides
- Instrumentation et nouveaux usages
- Analyse des données et recommandations

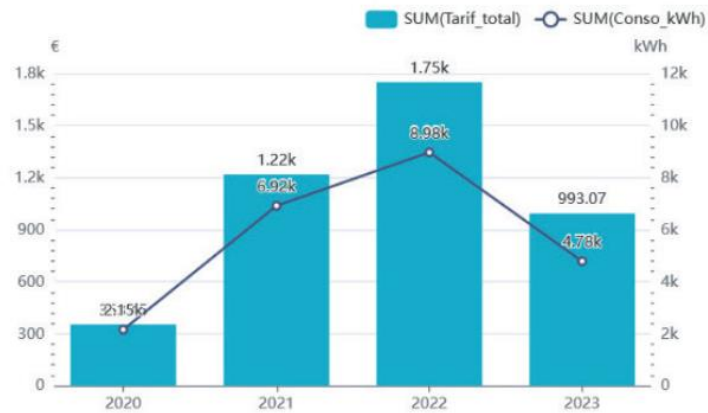
Répartition globale par type d'énergie



Répartition globale par type de bâtiment



Facture et consommation annuelles (€)



Evolution du prix du KWh réel (€/kWh)







# SUIVI DE PARKING DE CO-VOITURAGE

Suivre et comprendre les usages des parkings de co-voiturage. Evaluer les gains CO<sub>2</sub>

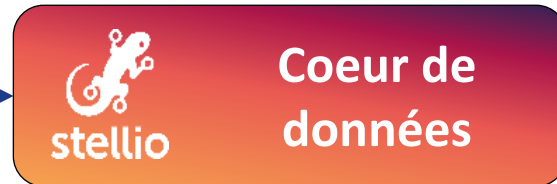
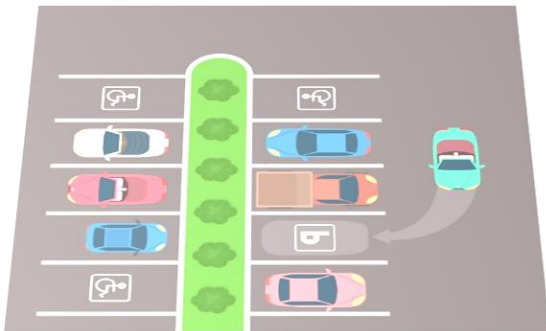
Anonymised usage patterns



Camera sur site –  
reconnaissance de  
plaques



Suivi entrées / sorties



Base de  
données  
vehicules

## Caractéristiques générales

Nombre de passages

Entrées

Sorties

Durées

Emissions CO2 évitées

Fidélité

Surveillance

Total

78 351

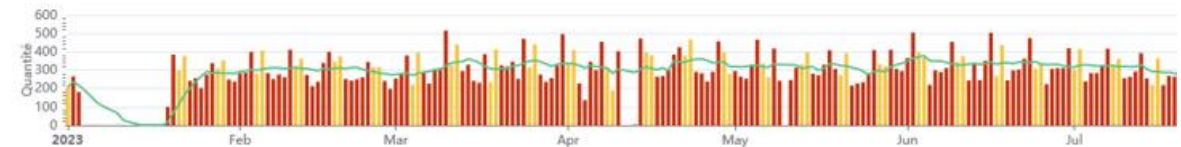
Jours ouvrés

269  
passages/jour

Weekends

298  
passages/jour

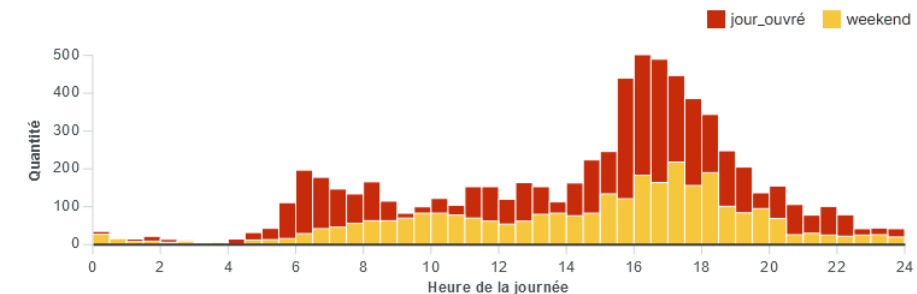
## Evolution des passages



Quantité totale des émissions de CO2 évitées

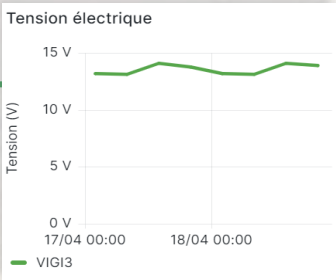
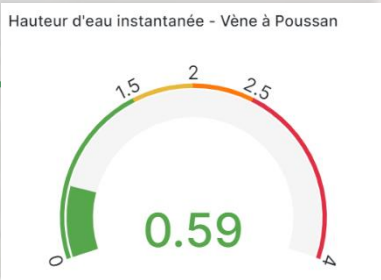
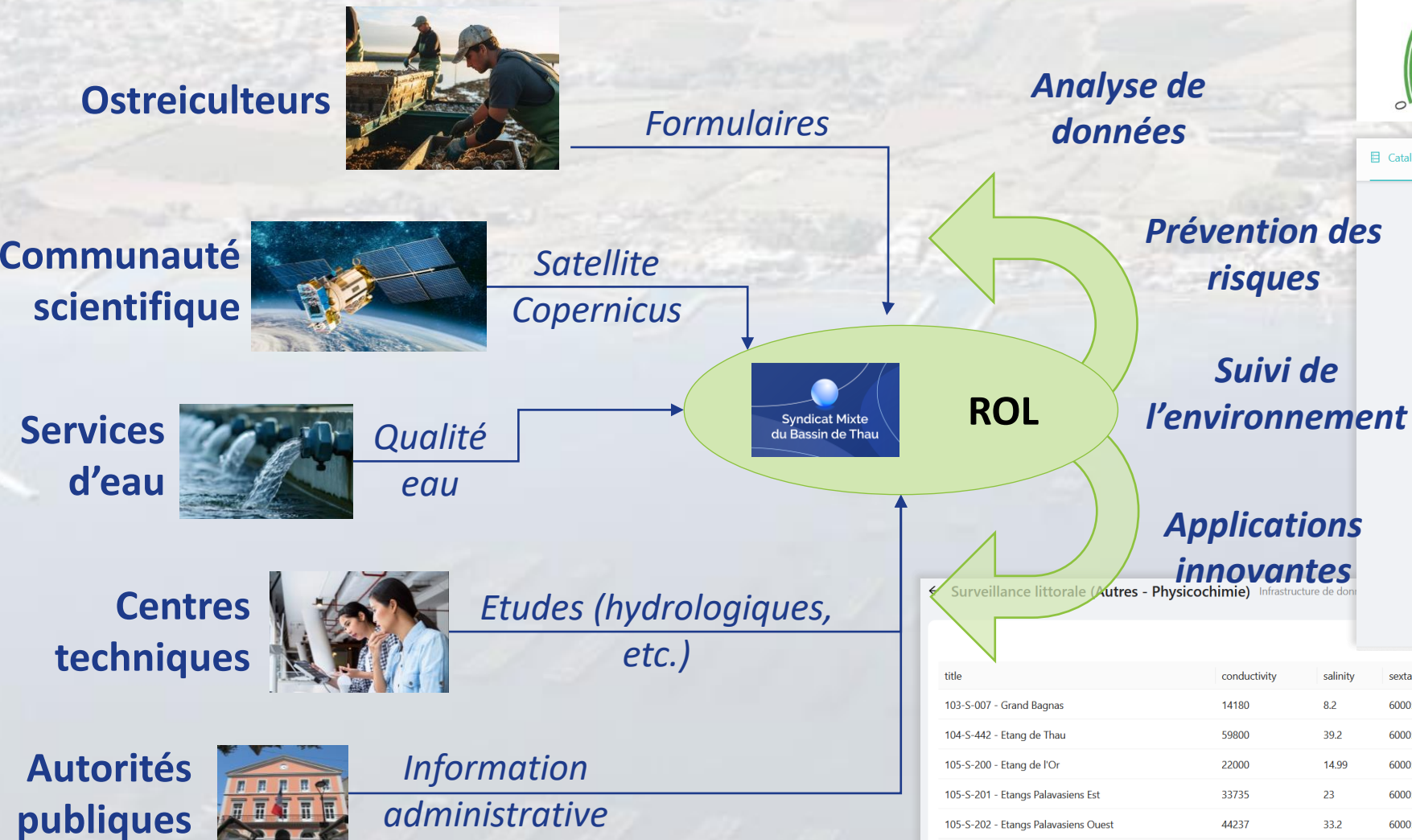
342  
tonnes

## Horaires des sorties





# RESEAU D'OBSERVATION LAGUNAIRE (THAU)



Catalogues Assignations 1

Rechercher un jeu de donnée par paramètre mesuré (ex: Salinité)

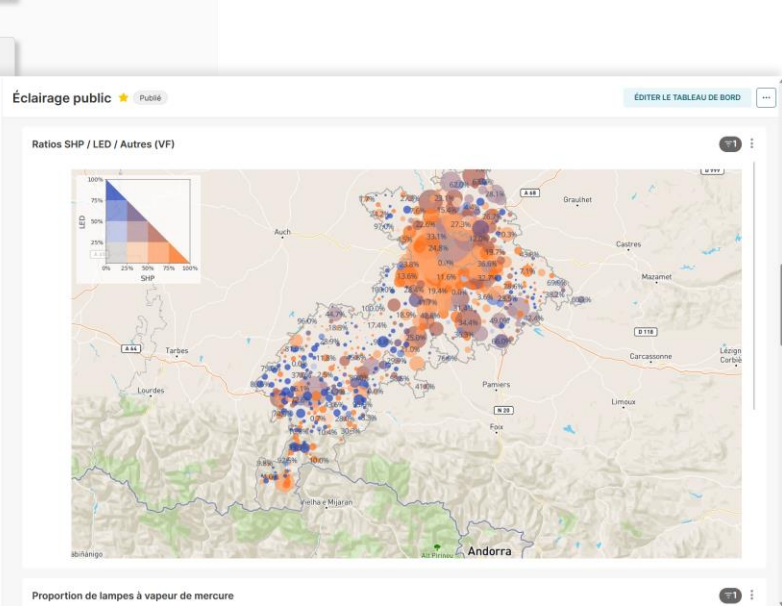
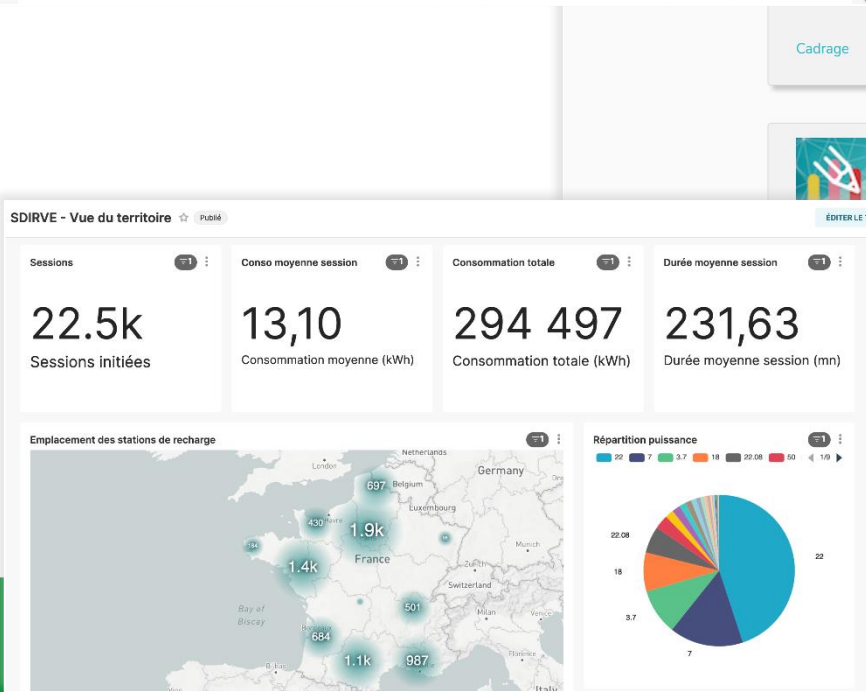
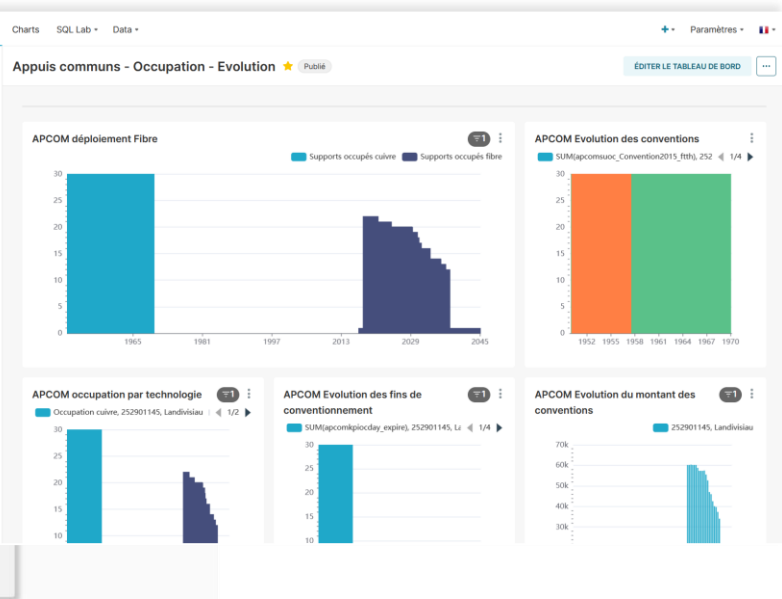
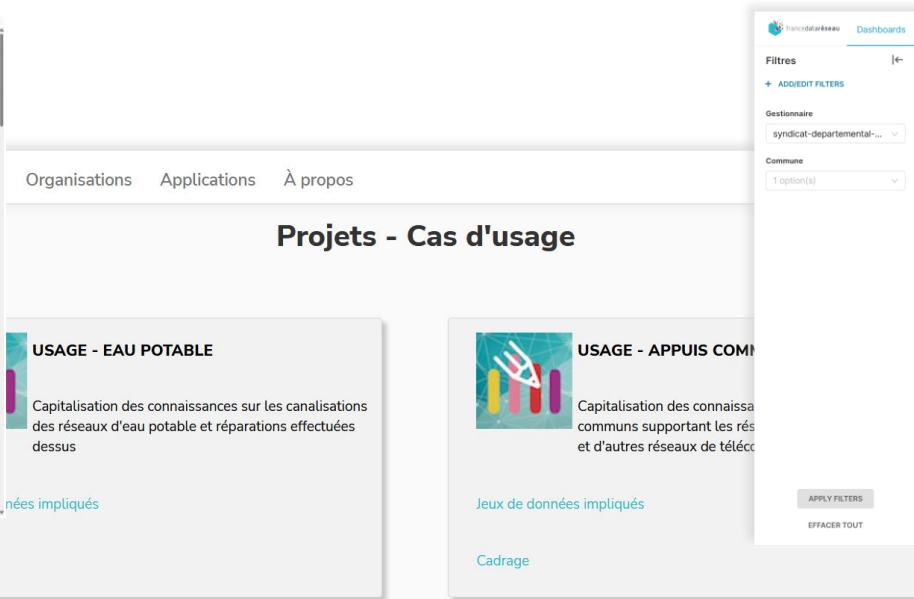
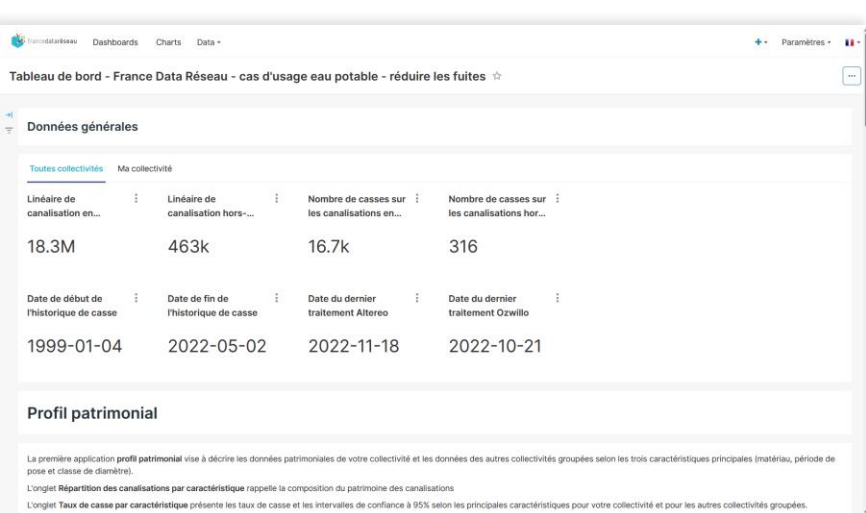
- BIODIVERSITÉ & HABITATS**  
Construire une base de données cartographiques de la biodiversité autour des élevages et des herbiers
- EAU & NUTRIMENTS**  
Compléter la connaissance sur les apports en nutriments et en eau
- PÊCHES & CULTURES MARINES**  
Construire un outil de collecte et de bancarisation des données sur la biomasse en élevage
- RISQUES & ENVIRONNEMENT**  
Mieux appréhender les risques environnementaux

Surveillance littorale (Autres - Physicochimie) Infrastructure de données

| title                                | conductivity | salinity | sextantCode | stationCode | Géolocalisation | Dernière modification | Données brutes |
|--------------------------------------|--------------|----------|-------------|-------------|-----------------|-----------------------|----------------|
| 103-S-007 - Grand Bagnas             | 14180        | 8.2      | 60005651    | 103-S-007   |                 | 12/09/2022            | JSON           |
| 104-S-442 - Etang de Thau            | 59800        | 39.2     | 60005684    |             | Géolocalisation | 2/09/2022             | JSON           |
| 105-S-200 - Etang de l'Or            | 22000        | 14.99    | 60005683    |             |                 | 2/09/2022             | JSON           |
| 105-S-201 - Etangs Palavasiens Est   | 33735        | 23       | 60005686    |             |                 | 2/09/2022             | JSON           |
| 105-S-202 - Etangs Palavasiens Ouest | 44237        | 33.2     | 60005662    |             |                 | 2/09/2022             | JSON           |

Colonne

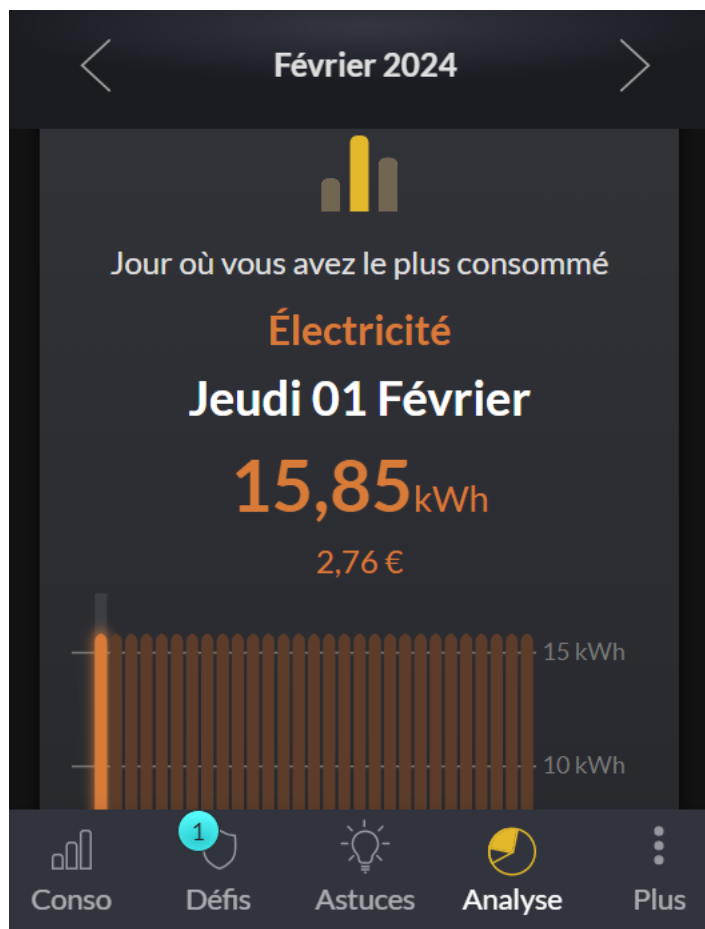
# FRANCE DATA RÉSEAU



<https://ckan.francedatareseau.fr/>

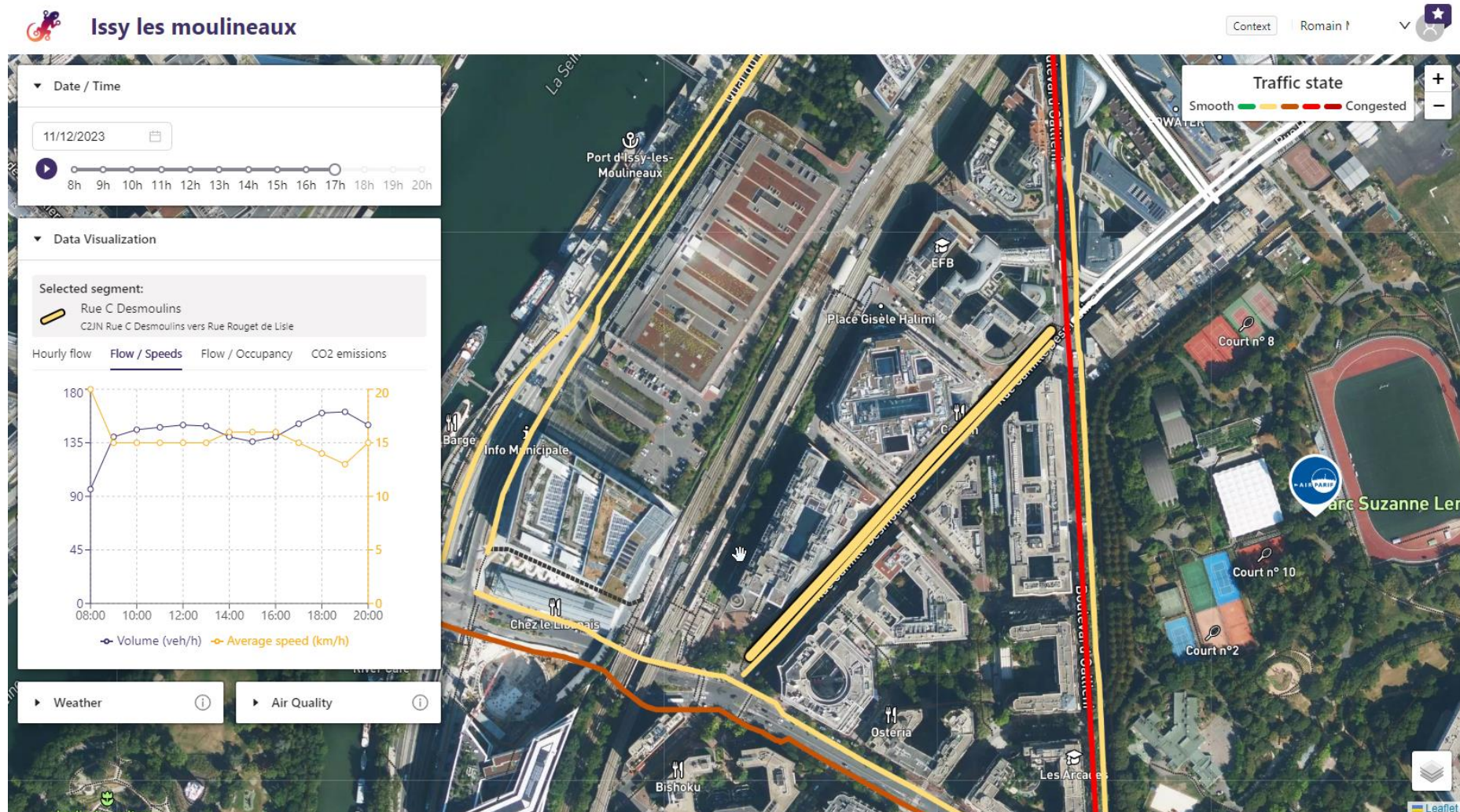
Présentation EGM

# APPLICATION MOBILE COMMUNAUTAIRE : SUIVI DES CONSOMMATIONS (CUD)





# SUIVI TRAFFIC / MODÈLES PRÉDICTIF

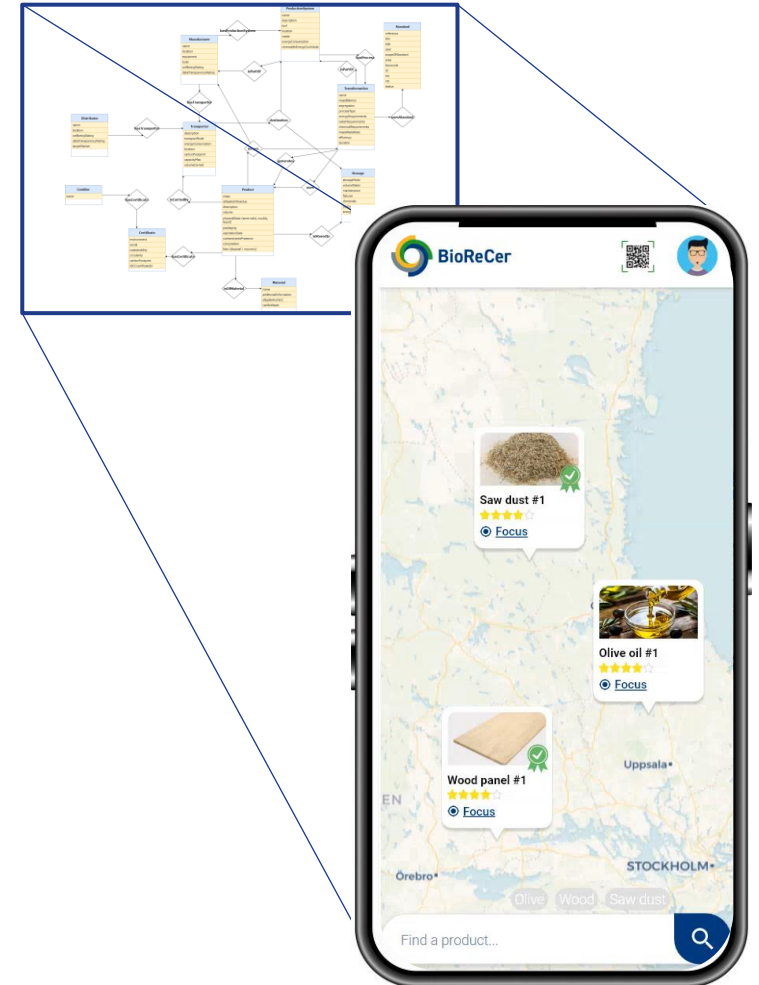




# BIOMASSE

## Projet R&D BioReCer : tracabilité des ressources biologiques

- Trouver des produits autour de moi et rechercher par mots-clés
- Visualisation et exploration de la chaîne d'approvisionnement
- Score d'impact environnemental
- Accès à une marketplace
- Page spécifique du produit
- Suivi numérique du produit



# Thank You!



**Franck Le Gall**

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[www.egm.io](http://www.egm.io)

