



# Big Data Processing and Apps for Citizens' Observatories - The CITI-SENSE Approach



**VGI and Crowdsourcing session,  
Lisbon, Portugal**

**Thursday May 28<sup>th</sup>, 2015, 1100-1120**

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### Latest News

#### Open Conference Presentations

The Citizens Observatories: Empowering European Society - Open Conference, organized by the European Commission Joint Research Centre took place on 4th December 2014, at the Brussels Hotel Bloom in Brussels, Belgium.

The conference provide opportunities to engage with experts and practitioners working across a range of European citizen science initiatives and policy making bodies, and to find out more about the work of the five Citizens' Observatory EU-funded projects, with a poster exhibition and live demos of the applications and sensors they have developed.

Presentations from the meeting are available on the [Downloads](#) page.

[Read More](#)

on December 11, 2014 in Events, General by Mike Kobernus

[Comment 0](#)

Tagged With: Conference Presentations / 310 Views ★★★★★

#### Citizens' Observatories: Empowering European Society Open Conference



on September 19, 2014 in Events by Mike Kobernus

[Comment 0](#)



#### Common presentations, brochures and other media

- [An Introduction to the five CO projects](#)
- [Overview of Technology in the five CO projects](#)
- [Citizen Participation in the five CO projects](#)

The five Citizen Observatory projects are funded by the EU as part of the topic ENV.2012.6.5-1 "Developing community based environmental monitoring and information systems using innovative and novel earth observation applications."



← 5 Citizen Observatory projects

# • Crowdsourcing workshop: Citizens' Observatories Infrastructures for Citizen Science and Crowd Sourcing - concepts, methodologies, apps and sensors with INSPIRE in mind, Friday May 29<sup>th</sup>, 1100-1700

## DETAILED WORKSHOP AGENDA

### 1100-1230: Introduction to VGI/Crowdsourcing and the project outdoor sessions

- **Citizens Observatories and VGI/Crowdsourcing** - Opening presentation by Jose Miguel Rubio Iglesias, European Commission, DG Research & Innovation, I4, Climate Actions and Earth Observation, Earth Observation
- **Research agenda on VGI** – Based on Cost [EnERGIC](#), Alexandra Fonseca, DGT, Portugal
- **[mvObservatory platform](#)**, [Yoram Rubin](#), University of Berkeley, USA
- **[AquaGIS project and outdoor sensors/apps on water quality](#)**, [Nuno Charneca](#), LNEC, Portugal, [Alexandra Fonseca](#), DGT, Portugal, [Cristina Gouveia](#), Azorean, Portugal.
- **[Citclops project and outdoor sensors/apps on water colour](#)**, [Luigi Ceccaroni](#), Barcelona Digital, Spain, [Raul Bardají](#) and [Joan Olivé](#), CSIC, Spain
- **[WeSenseIt project and outdoor apps on water flooding](#)**, • [Fabio Ciravegna](#), Univ. of Sheffield, UK, [Diogo Galvao](#), Hydrologic Research, Netherlands, N.N. [Starlab](#)
- **[CobWeb project and outdoor apps on biodiversity](#)**, [Bart De Lathouwer](#), OGC, Belgium, [Paul van Genuchten](#), GEOCAT, Netherlands, [Panos Terzis](#), Edina, UK
- **[CITI-SENSE project and outdoor sensor/apps on air quality](#)**, [Arne J. Berre](#), SINTEF, Norway and [Leonardo Santiago](#), [Ateknea](#), Spain

### 1230-1315-1430: Lunch and Outdoor observation session

# CITI-SENSE

## Project data

**Dates:** 01/10/2012-30/09/2016

**Duration:** 48 months

**Budget:** 12M€

**Partners:** 28 partner organisations from Europe, Israel, South Korea and Australia

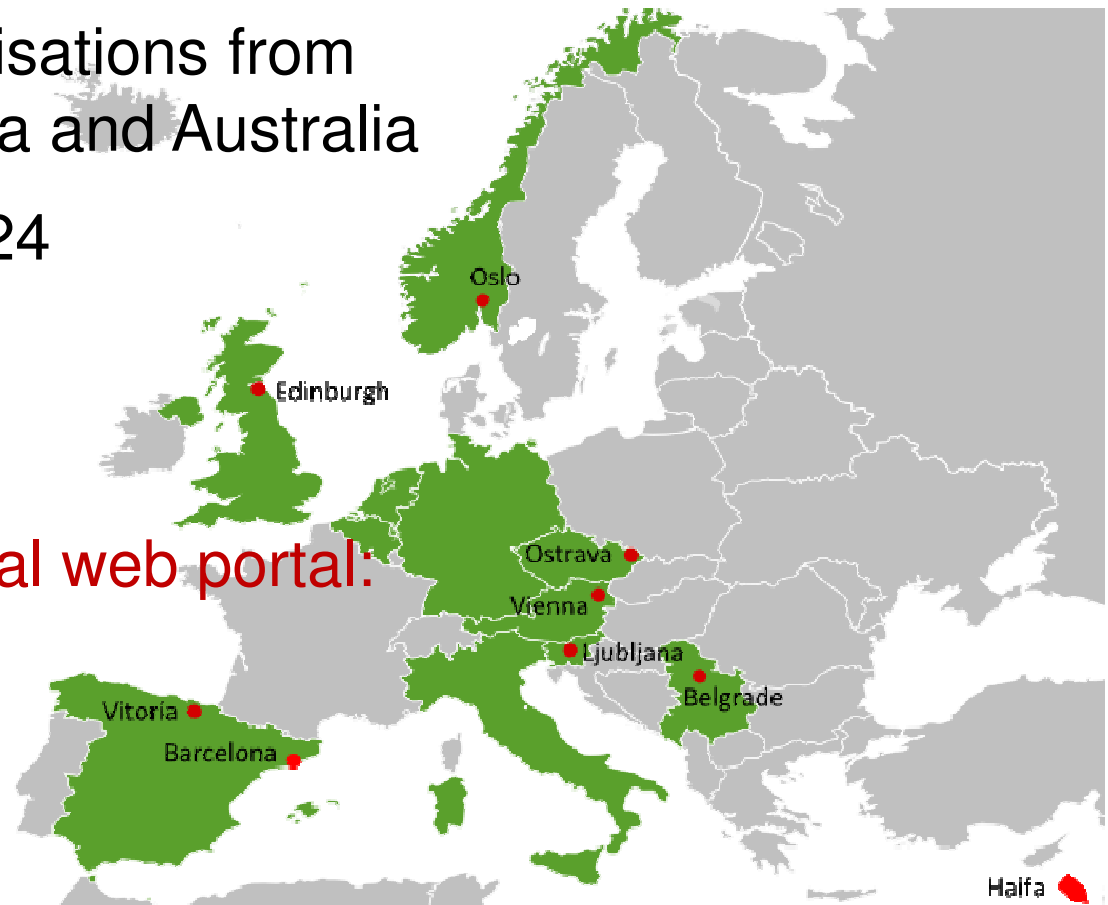
**Grant agreement n<sup>o</sup>:** 308524

**Project web portal:**

<http://www.citi-sense.eu>

**Citizens' observatory central web portal:**

<http://co.citi-sense.eu>



# CITI-SENSE partners

Partners:



*CITI-SENSE is a four year Collaborative Project partly funded by the EU FP7-ENV-2012 under grant agreement 308524, started in October 2012.*

# CITI-SENSE



- **Development of sensor-based Citizens' Observatory Community for improving quality of life in cities**
- **Citizens' observatories** – *communities that share technological solutions, information products and services and community participatory methods. Complementing established environmental data and information systems, improving local environmental decision making.*
- Nine cities (Barcelona, Belgrade, Edinburgh, Haifa, Ljubljana, Oslo, Ostrava, Vienna, Vitoria) use sensors to gather data on outdoor urban spaces and indoor school environments.

# CITI-SENSE | Mobile Sensors



[www.citi-sense.eu](http://www.citi-sense.eu)



# CITI-SENSE Sensor platforms for Air Quality Sensors

- **Mobile Personal Sensor Package (PSP) Solution/apps – Ateknea with Sensing&Control – (In Crowdsourcing workshop, Outdoor session in Lisbon on Friday May 29th, 1100-1700)**
- Atmospheric sensors –Atmospheric
- Geotech/EnviroLogger– Geotech
- Radon sensor –OBEO
- SenseltNow – Spanish Vittoria app with SensApp/WFS – NILU, Tecnalia, (SINTEF)
- DUNAVNET platform – Dunavnet
- VESNA platform – JSI



# Personal Sensor Pack (PSP)

The Personal Sensor Pack developed by Ateknea is equipped with the following sensors:

- NO<sub>2</sub>, O<sub>3</sub>, CO (ppb)
- Temperature (°C)
- Relative Humidity (%)
  
- USB connectivity
- Bluetooth 2.0
  
- New version released May 2015



# In situ sensors



Login 

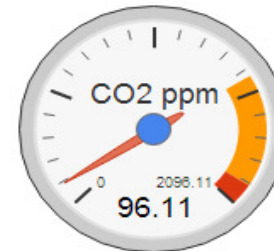
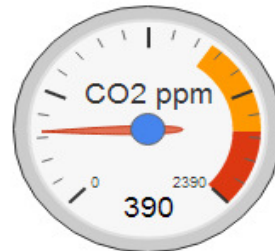
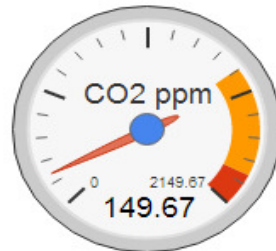
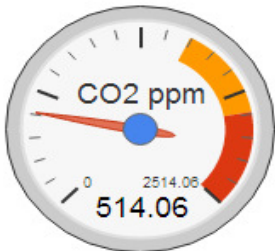
 

- HOME
- ABOUT THE SCHOOL
- THE SENSORS
- CONTACT

Home

## Temperature and CO<sub>2</sub> in my classroom right now

The data are preliminary data and error may occur



### View data from the sensors

Here you will find more detailed data from the sensor units located at our school.  
[Read more...](#)



### Facts

Indoor air quality greatly affects our health, well-being and performance. Here you will find useful information and practical advices about indoor air quality at the school. [Read more...](#)



### Why do we measure?

Why do we measure indoor air quality and what can we use the measurements for?  
[Read more...](#)



### Campaigns and surveys

Here you can participate in on-going campaigns and view results from the campaigns. You may also establish new campaigns at you school. [Read more ...](#)

# SenseItNow app

Home WP3

mff@nilu.no

Start Stop 00:00:18

Last measured

Wind Speed	0m/s	(11/06/2014 11:00:53)
Temperature	26.8°C	(11/06/2014 11:00:53)
Humidity	49.2%	(11/06/2014 11:00:53)
Sound	36.67	(26/09/2014 13:25:57)

View evolution View results

New-observation View observations

Questionnaire

Home WP3 Thermal Acoustic

Acoustic Comfort

Index 4.97

Excellent  
Good  
Acceptable  
Need test  
Substandard

Sound indicators  
LAeq- 4474069.98 of 2 minutes  
LAeq 1sec max= 80.99 3 unpleasant  
LAeq 1sec min= 2.02 5 pleasant

Dominant noise sources  
Focus 1 Focus 2

Rating soundscape as

Email all results

Home WP3 Thermal Acoustic

Thermal Index

Area 1 CI.Cover 2 Clothing 0.9  
Site 1 Radiation 0 Height 175  
Age 35 Gender 1 Weight 75

Thermal Comfort  
PET Index 17.83

Heat 25.81 °C  
Wind 0.00 m/s  
Hum. 23.90 %

Input values Calculate

Email all results

Home WP3 View evolution

Temperature

Sound pressure (Bspl)

Home WP2 Physical activity Graph

Activity intensity

Vigorous  
Moderate  
Light  
Sedentary

Home WP3 Questionnaire

CITI-SENSE

Vitoria-Gasteiz (estudio piloto)

Recogiendo sus opiniones

Parte 1a. Datos de la persona partic...  
En este apartado le pedimos algunos datos socl...

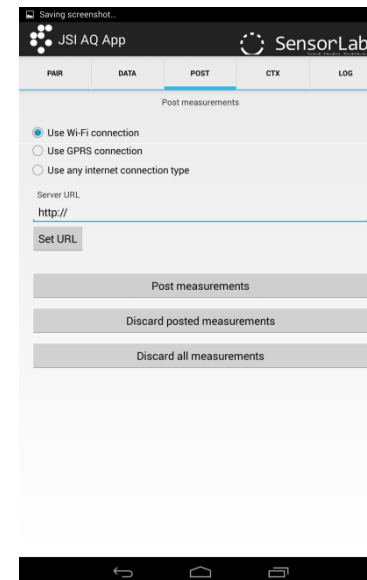
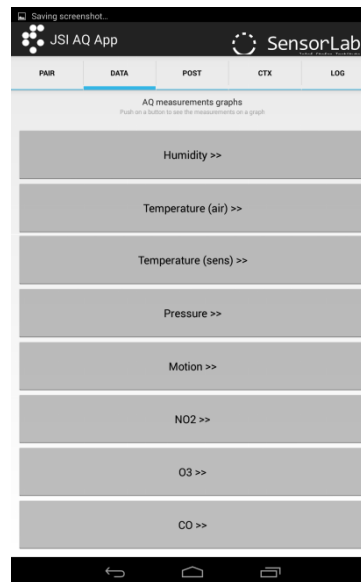
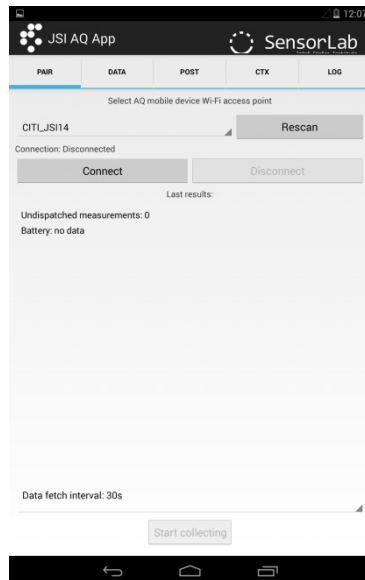
Parte 1b. Salud y Estilos de Vida  
Estas son unas breves cuestiones sobre cómo p...

Parte 2. Lugares y Confort  
A continuación aparecen una serie de cuestione...

Home WP2 Physical activity Map

Sabadell  
Gerdanyola del Valles  
Badalona  
Barcelona

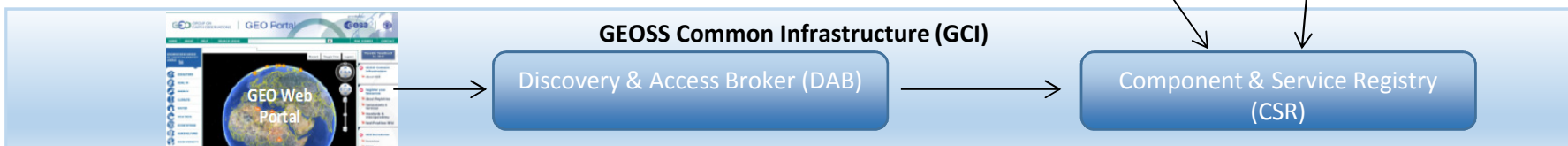
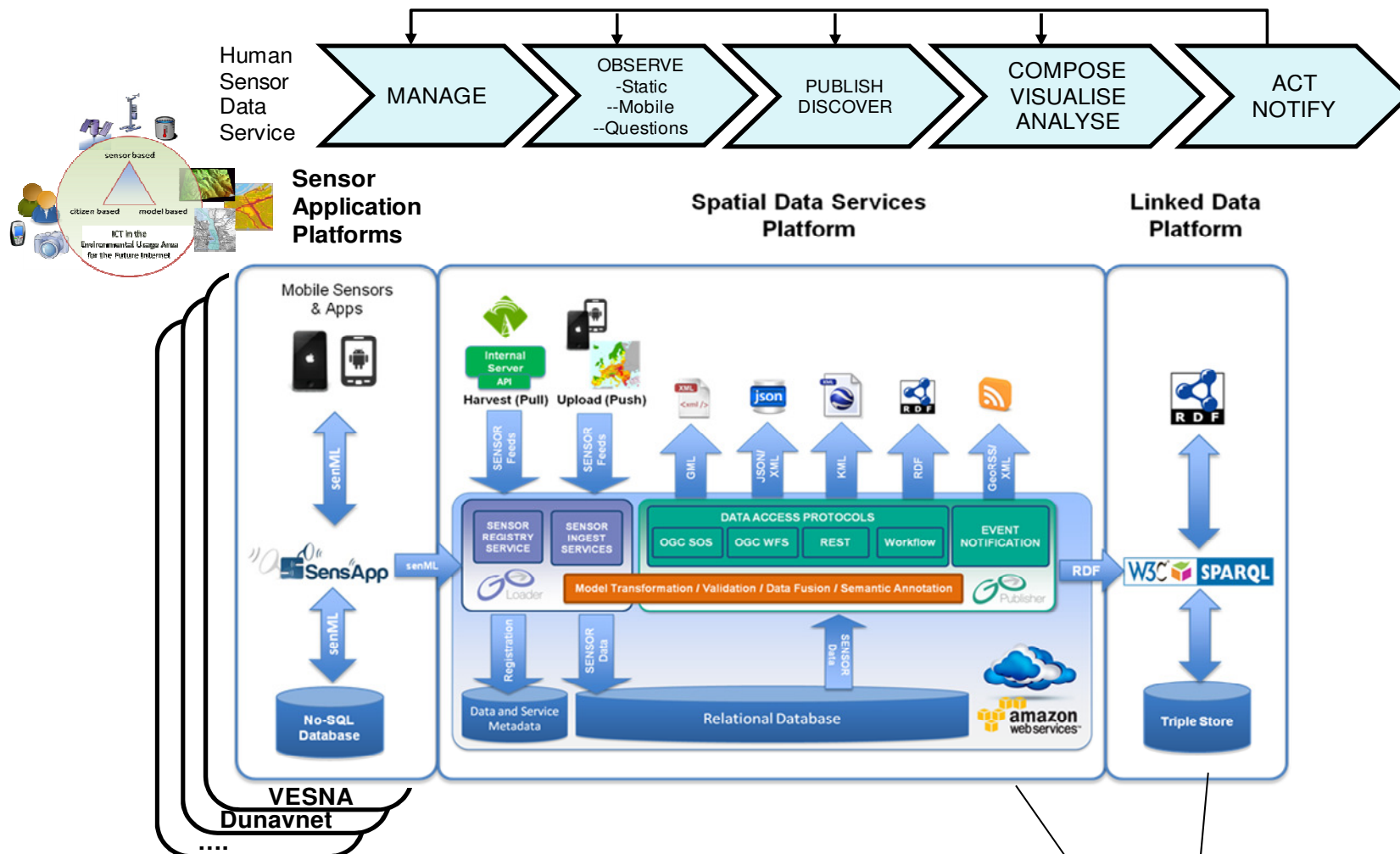
# VESNA App

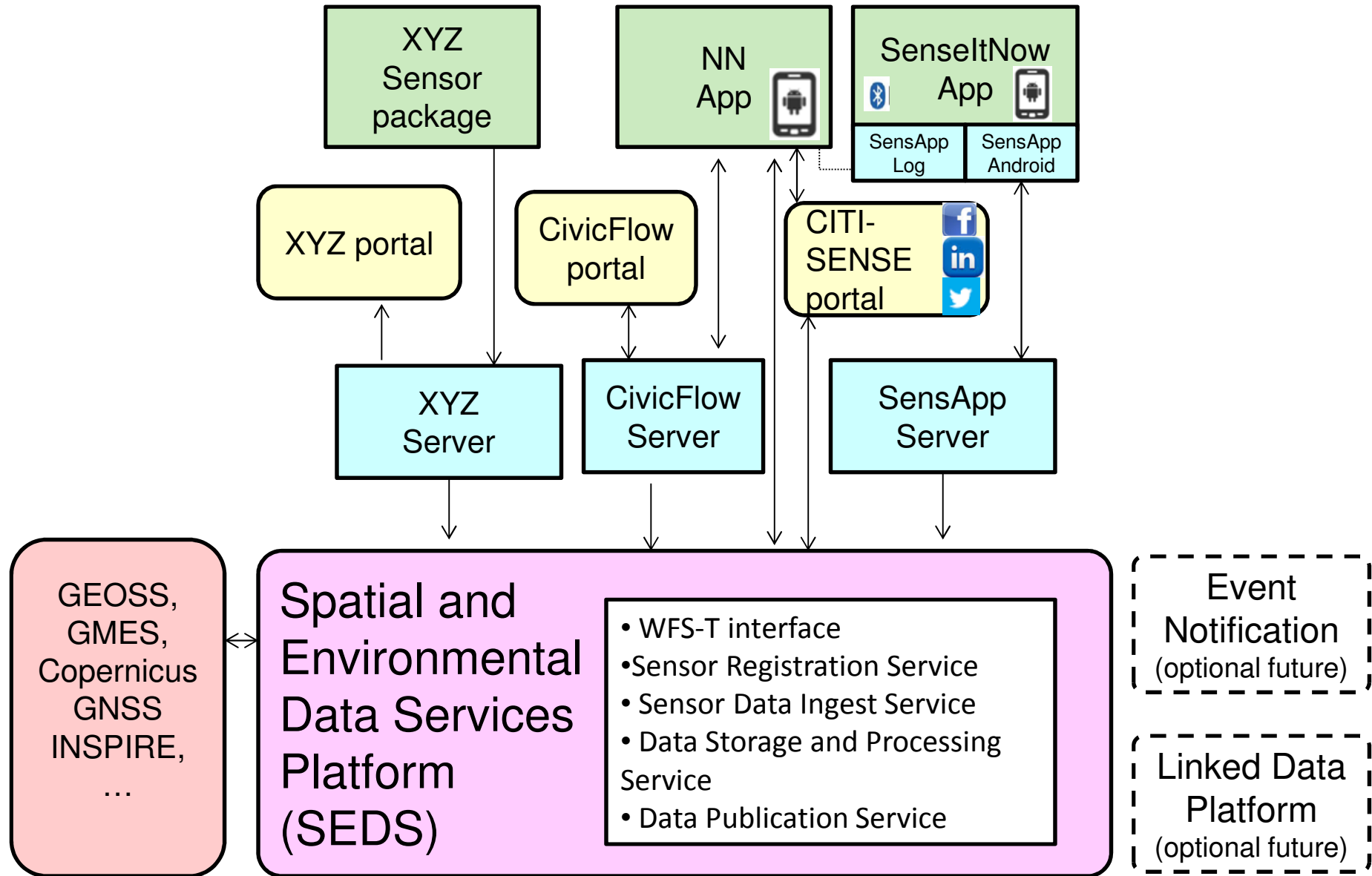
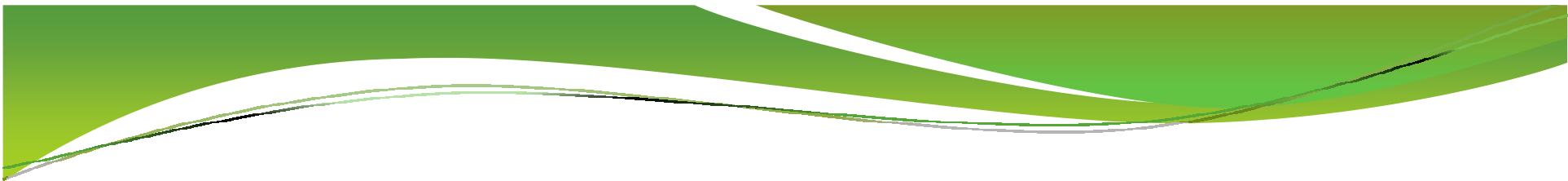


This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 308524

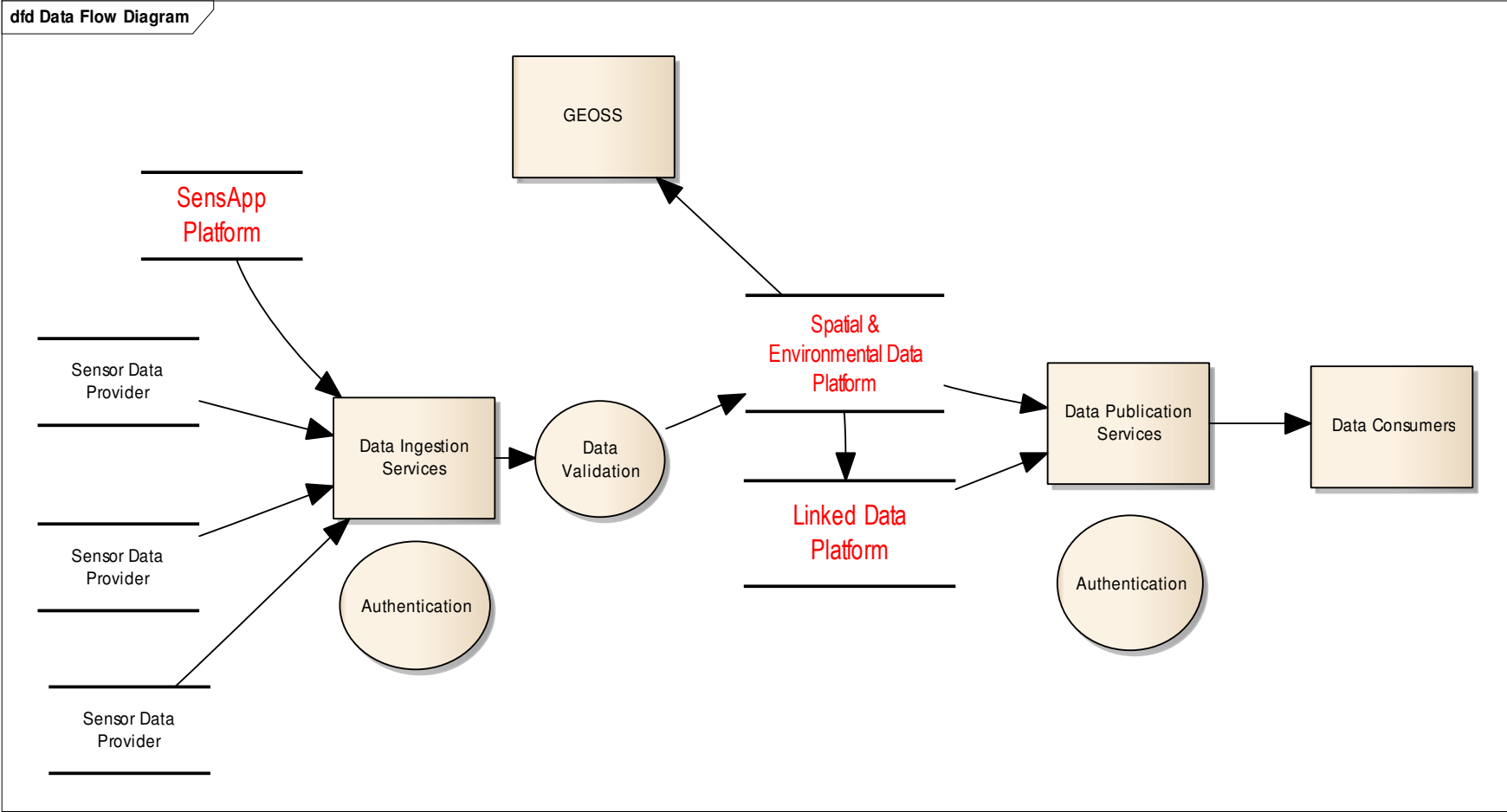


# CITI-SENSE Platform

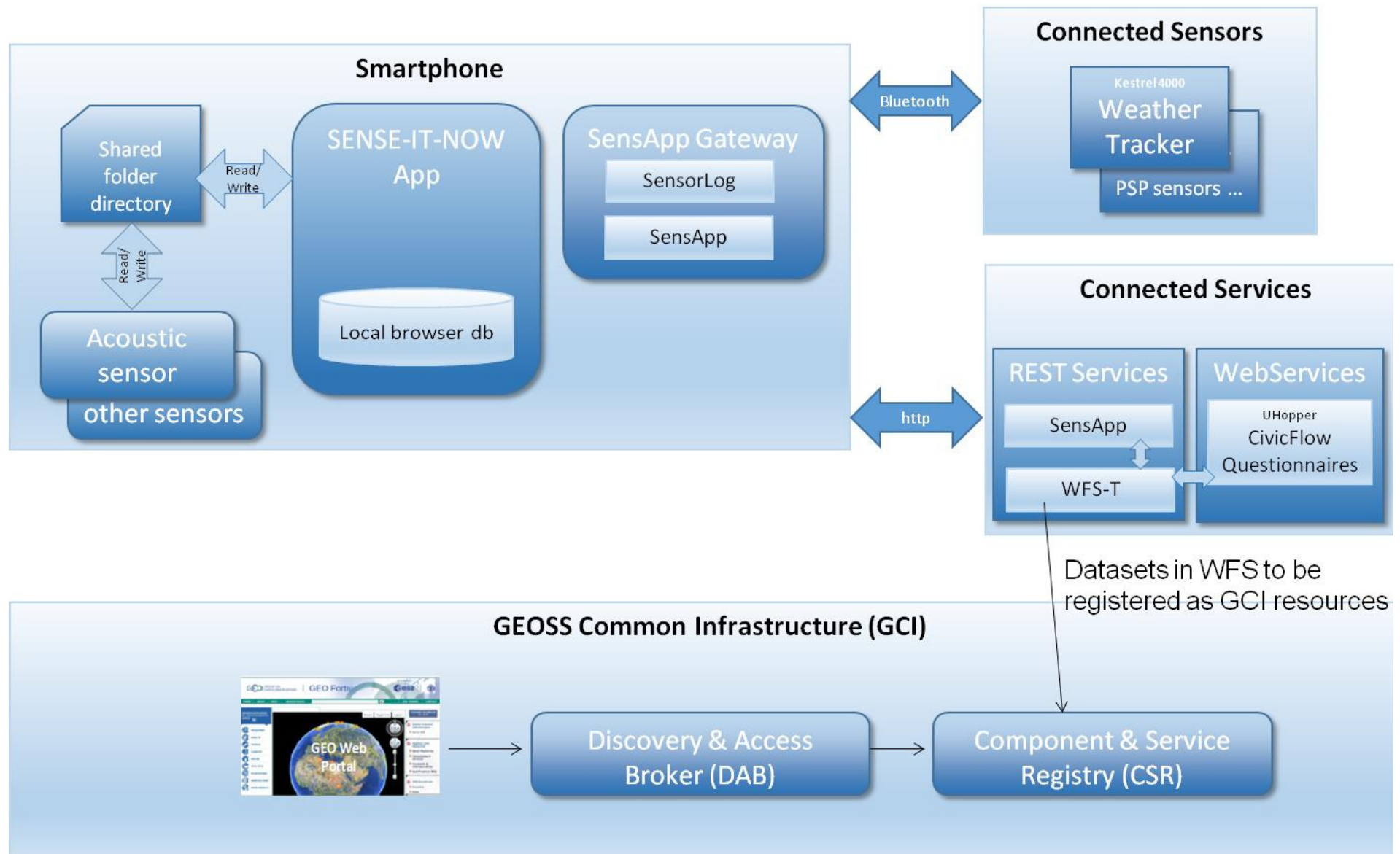




# CITI-SENSE Platform Data flow

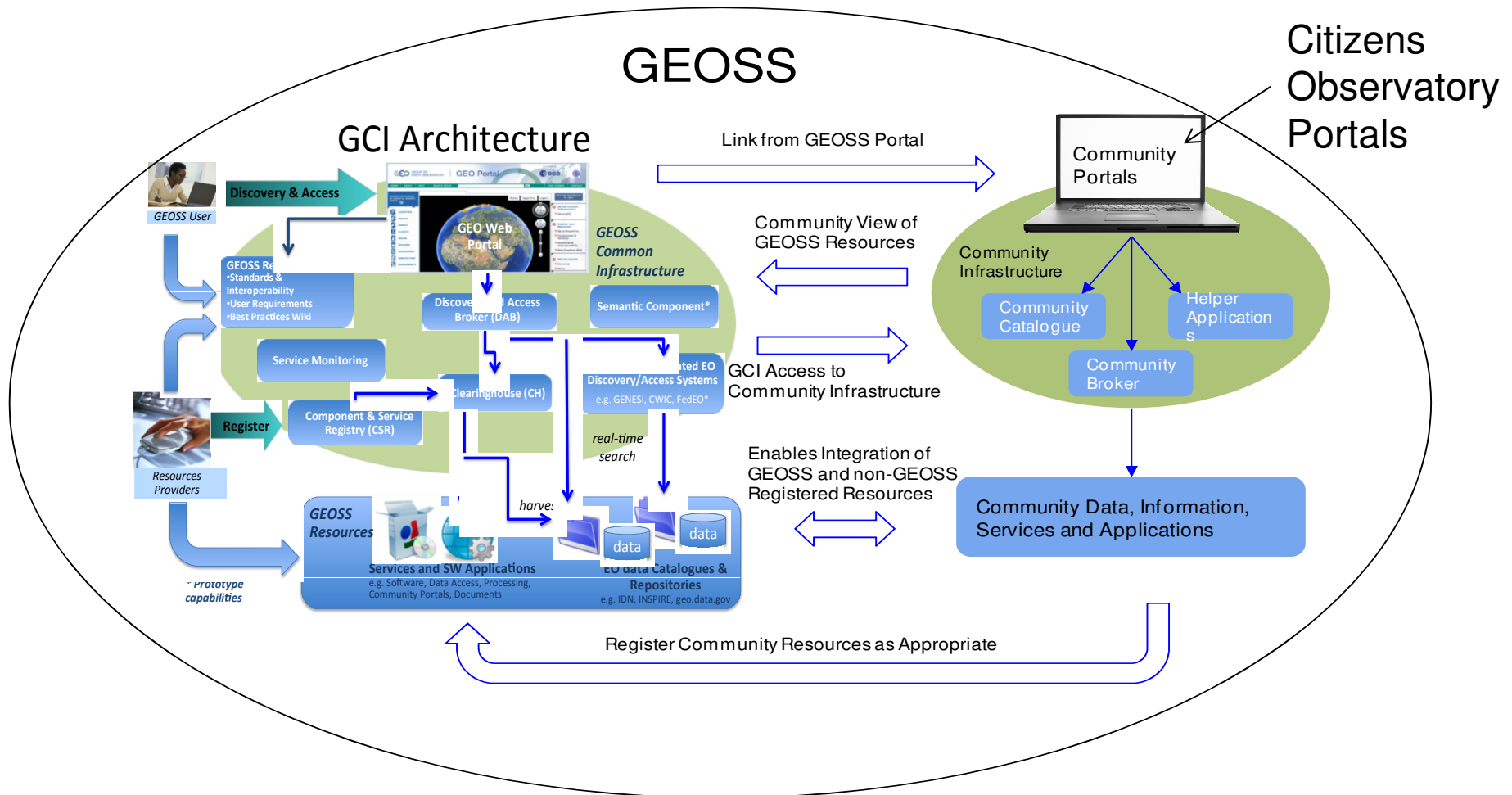


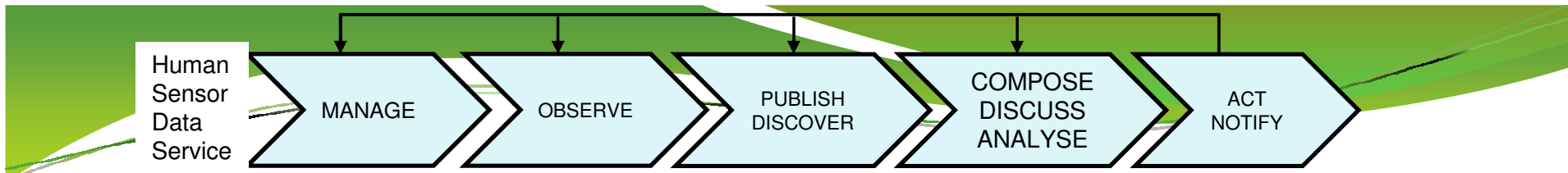
# CITI-SENSE and GEOSS





# GEOSS and Community portals





### GEOSS/INSPIRE/Member State Common Infrastructures

#### Registries

Components & Services

Standards & Interoperability

Best Practices

User Requirements

Vocabularies

GEO Portals

Discovery Service

Discovery & View Application

Metadata editor

GEOSS Clearinghouse

### CITI-SENSE Observatory

Citizen Participation

User Empowerment  
Social media

Protocol for Citizen Empowerment

Web Apps, **Mobile Apps**, GEO-PORTALS, REPORTING

CITI-SENSE Products and Services

#### Business Process Tier

**Registers:**  
Ontologies  
App Schemas  
.....

User & Rights Management

Workflow Management & Orchestration (Service Chaining)

Uncertainty Handling & Provenance

Semantic Annotation, Mediation & Discovery

Data Composition & Fusion Services

Visualisation & Portrayal Services

Model Transformation & Model-as-a Service

#### Sensor Platform Tier

##### Smart Phone Mobile Sensors

Mobile Devices, Apps, VGI



Bluetooth Low Energy (BLE)

##### In situ/Mobile Sensors

Wi-Fi

Intelligent Gateways



Adaptive Sensors (ThingML, Contiki, TinyOS, ...)

#### Data Access Tier

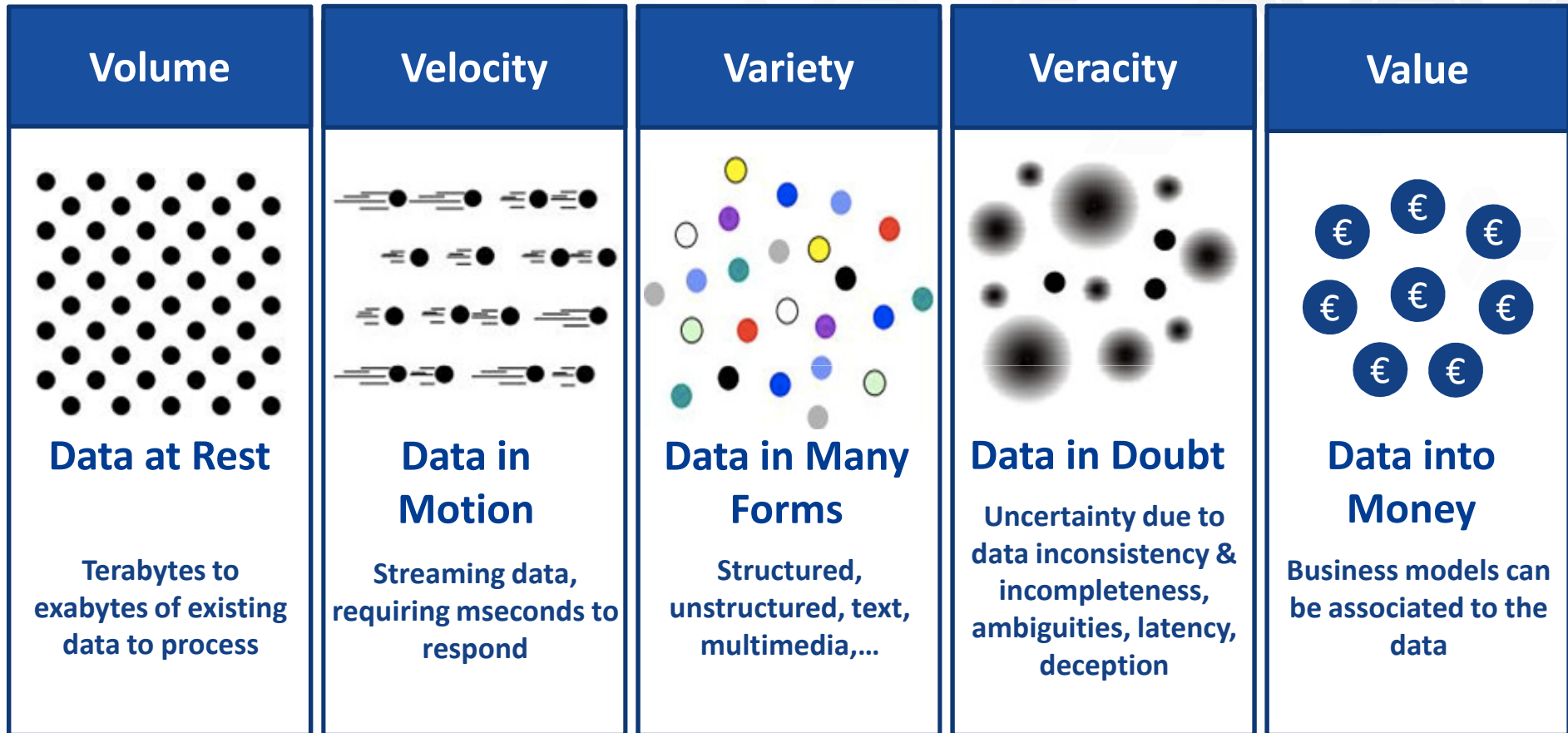
OGC Web Services (**WFS**, WCS, SOS)

Event Services (WS-N, SAS, SES)

**Linked Data Services**

Download Services

# The Big Data V's



Operational, Archive

Big Data Processing

WFS, Linked Data



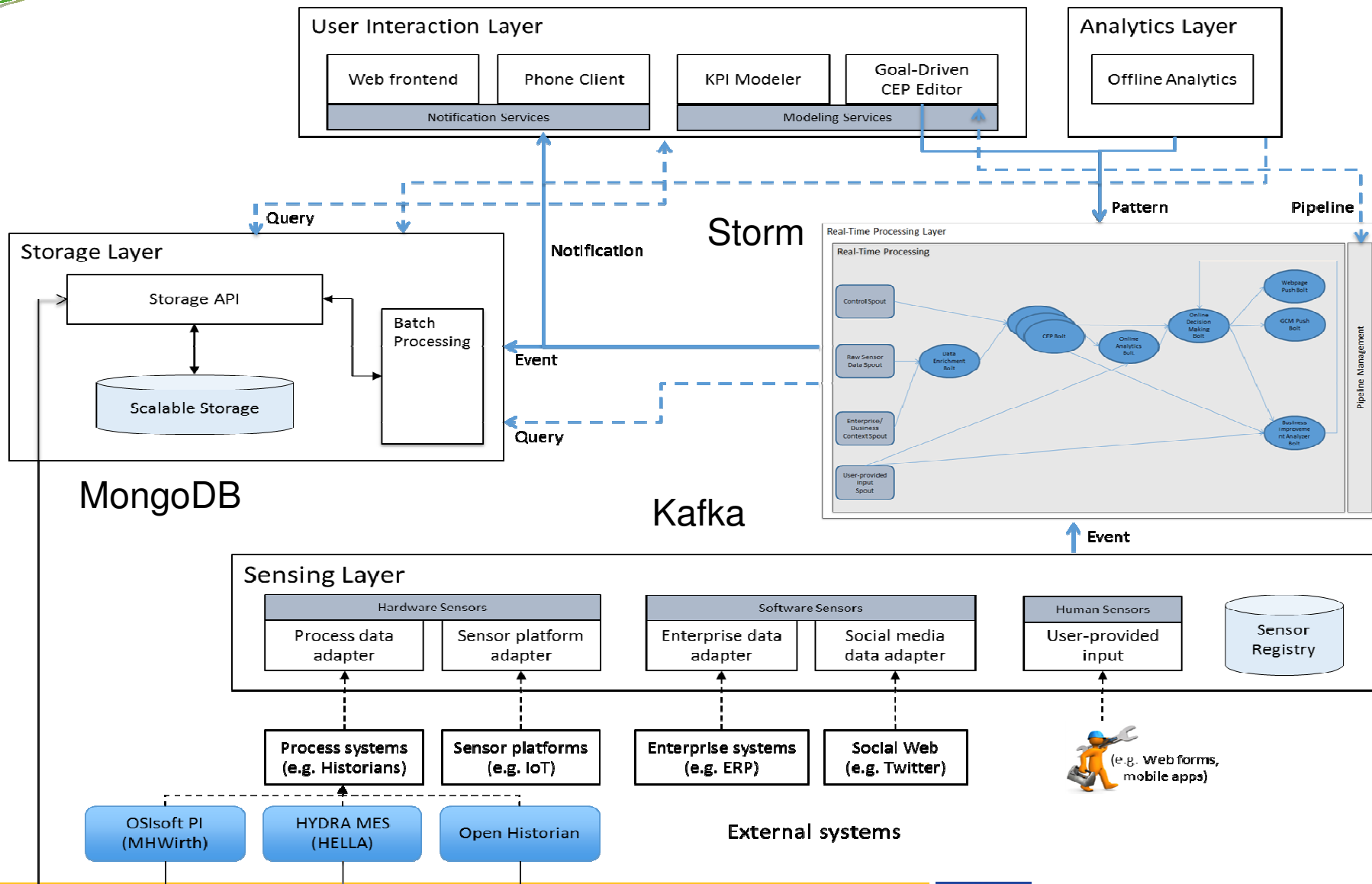
pro  sense

*The Proactive Sensing Enterprise*

<http://www.proasense.eu>

**Big Data stream processing – with  
predictions and detection of events**

# ProaSense – Big Data Event architecture





# Apache Kafka

A high-throughput distributed messaging system.

- [download](#)
- [introduction](#)
- [uses](#)
- [documentation](#)
- [quickstart](#)
- [performance](#)
- [clients](#)
- [ecosystem](#)
- [faq](#)
- [project](#)
  - [◦ twitter](#)
  - [◦ wiki](#)
  - [◦ bugs](#)
  - [◦ mailing lists](#)
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  - [◦ coding guide](#)
  - [◦ unit tests](#)

Apache Kafka is publish-subscribe messaging rethought as a distributed commit log.

## Fast

A single Kafka broker can handle hundreds of megabytes of reads and writes per second from thousands of clients.

## Scalable

Kafka is designed to allow a single cluster to serve as the central data backbone for a large organization. It can be elastically and transparently expanded without downtime. Data streams are partitioned and spread over a cluster of machines to allow data streams larger than the capability of any single machine and to allow clusters of co-ordinated consumers

## Durable

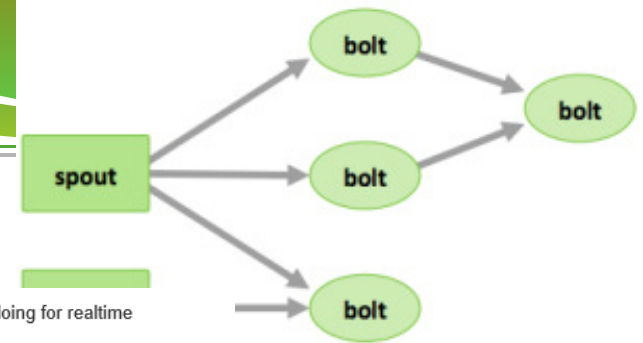
Messages are persisted on disk and replicated within the cluster to prevent data loss. Each broker can handle terabytes of messages without performance impact.

## Distributed by Design

Kafka has a modern cluster-centric design that offers strong durability and fault-tolerance guarantees.

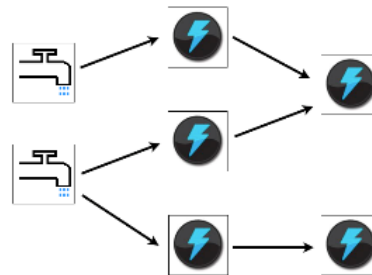


# Apache Storm



Apache Storm is a [free and open source](#) distributed realtime computation system. Storm makes it easy to reliably process unbounded streams of data, doing for realtime processing what Hadoop did for batch processing. Storm is [simple](#), can be used with [any programming language](#), and is a lot of fun to use!

Storm has many use cases: realtime analytics, online machine learning, continuous computation, distributed RPC, ETL, and more. Storm is fast: a benchmark clocked it at over a million tuples processed per second per node. It is [scalable](#), [fault-tolerant](#), [guarantees your data will be processed](#), and is [easy to set up and operate](#).



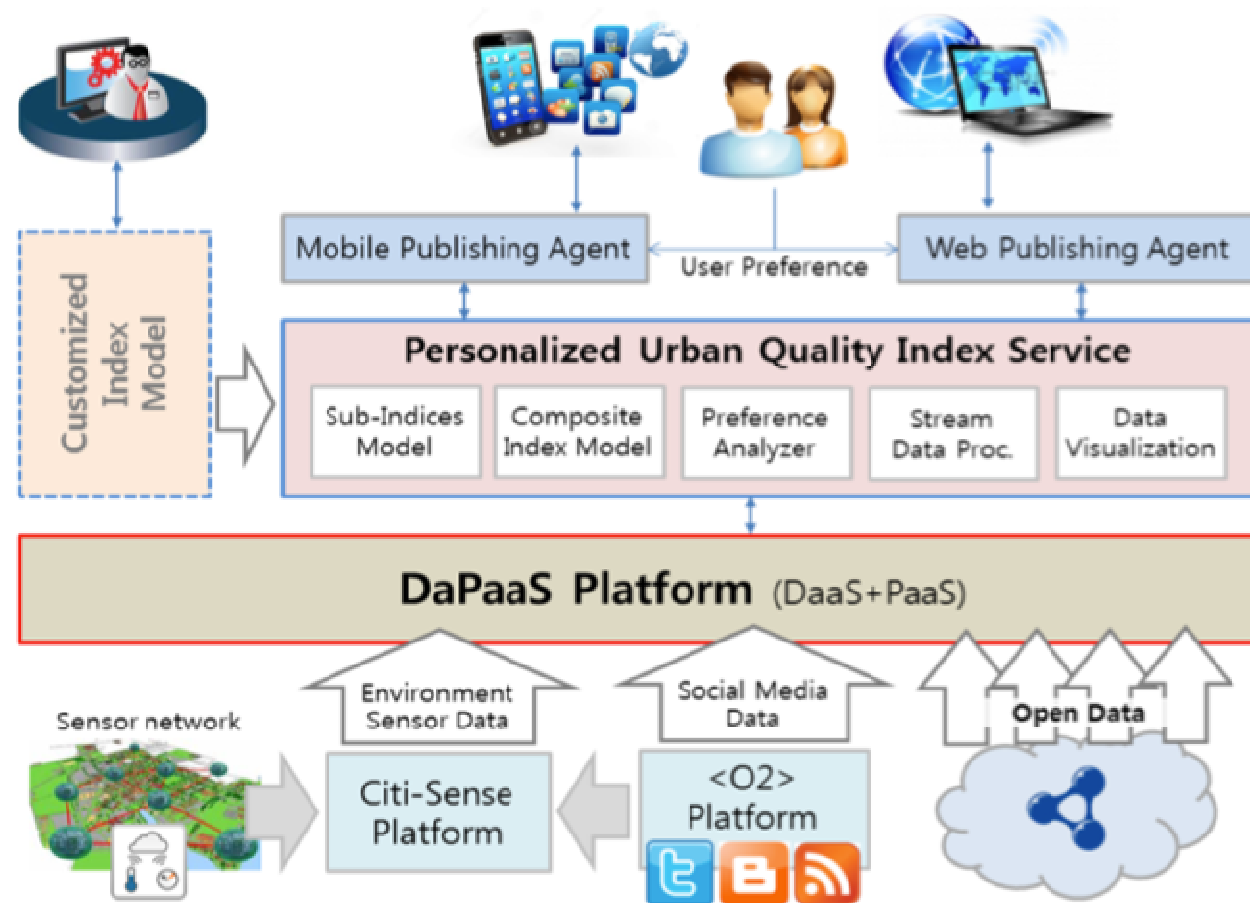
- Bolts and spouts
- Stream-based communication
- Polling input, push-based internals
- Distributed and resilient

Storm [integrates](#) with the queuing and database technologies you already use. A Storm topology consumes streams of data and processes those streams in arbitrarily complex ways, repartitioning the streams between each stage of the computation however needed. Read more in [the tutorial](#).

## Companies & Projects Using Storm



# Extending CITI-SENSE with Linked Data



Data- and Platform-as-a-Service

<http://project.dapaas.eu>





**DAPaaS**

Data- and Platform-as-a-Service

<http://dapaas.eu>

**How can we simplify  
Linked Open Data  
publication and consumption?**

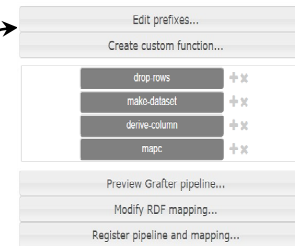
# DaPaaS – Enablers

## Grafter



## Grafterizer

(Graphical Tool & DSL)



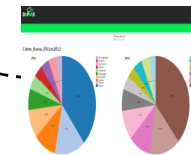
## DaPaaS platform



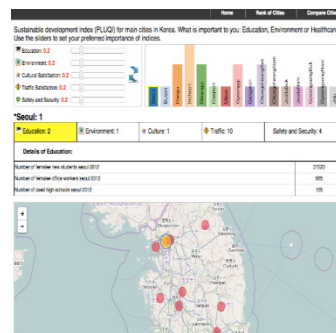
## RDF database-as-a-service



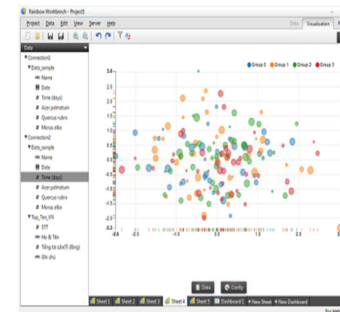
## RDF



## PLUQI



## Open Data Visualization-as-a-service



# Citizens' Observatories Web Portals



Tell me and I will forget.  
Show me and I will remember.  
Involve me and I will understand.  
*Ancient Chinese proverb*

Search...

HOME ABOUT US COMMUNITY EMPOWERMENT INITIATIVES CONTACT US

You are here: Home

## Share - Collaborate - Communicate



The CITI-SENSE public portal is designed to enable citizens to not only have access to real-time environmental information provided by a wealth of sensors, including personal sensors, mobile sensors and static stations, but also to provide a forum for discussion, debate and sharing of YOUR own personal observations. Your contributions are important and the Citizens' Observatory is yours!

**Citizens' Observatories**

- City Air Quality**  
View data on air quality in our European cities...
- Public Spaces**  
Urban public spaces in these test sites...
- Air Quality in Schools**  
Test schools are studying indoor air.
- Your Voice**  
Let your voice be heard.

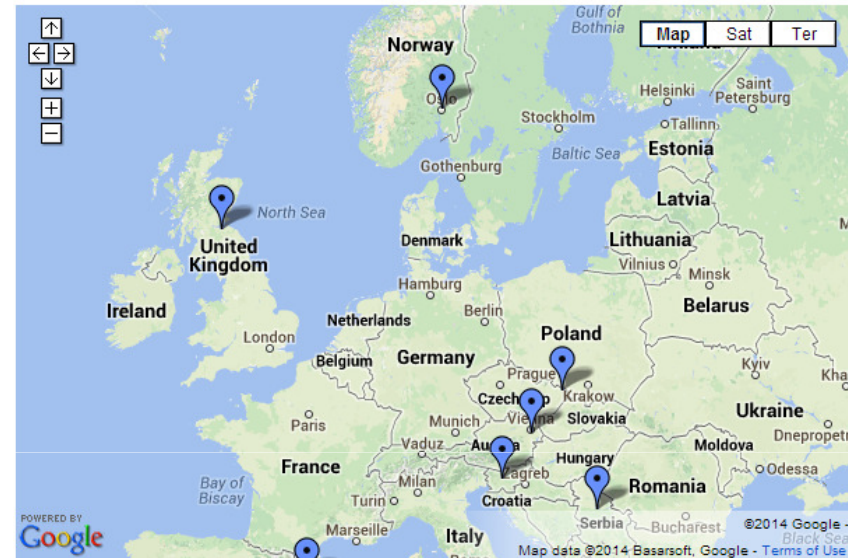


THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS  
INFORMATION FOR THE BENEFIT OF SOCIETY

The GEOSS initiative enables the gathering of data on a wide spectrum of themes. For the CITI-SENSE project we supply data related to the Environment. This includes data on Noise, Air Quality, Thermal Comfort, UV Radiation, etc.

Our data will be made discoverable in the GEOSS portal. This portal is main entry point to Earth Observation data from all over the world.


Facebook LinkedIn  
Twitter YouTube



### Oslo Pilot

Last Updated by Mike on Dec 10, 2012

Indoor Air in Schools is the focus of this pilot study. One school in Oslo will be outfitted with Sensors in the classroom which will upload data on air quality, in real time, to our central server. This data will then be used to calculate the actual air quality levels in the classrooms.



Directions Search nearby Save to map more

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# Thank you for your attention!

## – Find us on

- ❖ CITI-SENSE CO's central web portal: <http://co.citi-sense.eu>
- ❖ Common CO project's web site: <http://www.citizen-obs.eu/>
- ❖ LinkedIn: <https://www.linkedin.com/groups/Citizens-observatories-5164755>
- ❖ Facebook: <https://www.facebook.com/int.cit.obs>
- ❖ Twitter: <https://twitter.com/Citizensobs>
- ❖ Email: [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)
- ❖ CITI-SENSE web site: <http://citi-sense.nilu.no/>