EnviroInfo 2013
ICT and Renewable Energies

SEVENTH FRAMEWORK PROGRAMME
OMNISCIENTIS
(308427)

Environmental Information System and Odour Monitoring based on Citizen and Technology Innovative Sensors

Ph. Ledent[1], B. Stevenot[6], J. Delva[2], W. Kunz[3], A-C Romain[4], U. Uhrner[5], Ph. Valoggia[7], Y. Arnaud[1], A. De Groof[1], V. Hutsemekers[2,4], G. Grosso[5], L. Johannsen[7]

1 SPACEBEL
2 ODOMETRIC
3 KTT-iMA Kunz Technologie Transfert - Richter & Röckle
4 Université de Liège
5 TU Graz Graz University of Technology
6 APS TECHNOLOGY
7 tudor PUBLIC RESEARCH CENTRE HENRI TUDOR
BURGO ARDENNES
iew

1. Description of the problem

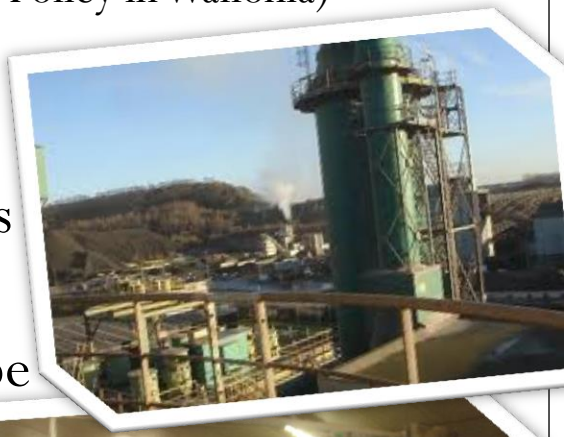
Odour = strong / severe nuisance

•

Second source of complaints (ADEME in France and Environmental Policy in Wallonia)

•

In contrast with air pollutants or noise,
odour monitoring limitations and regulations
=
complex and non-homogeneous across Europe



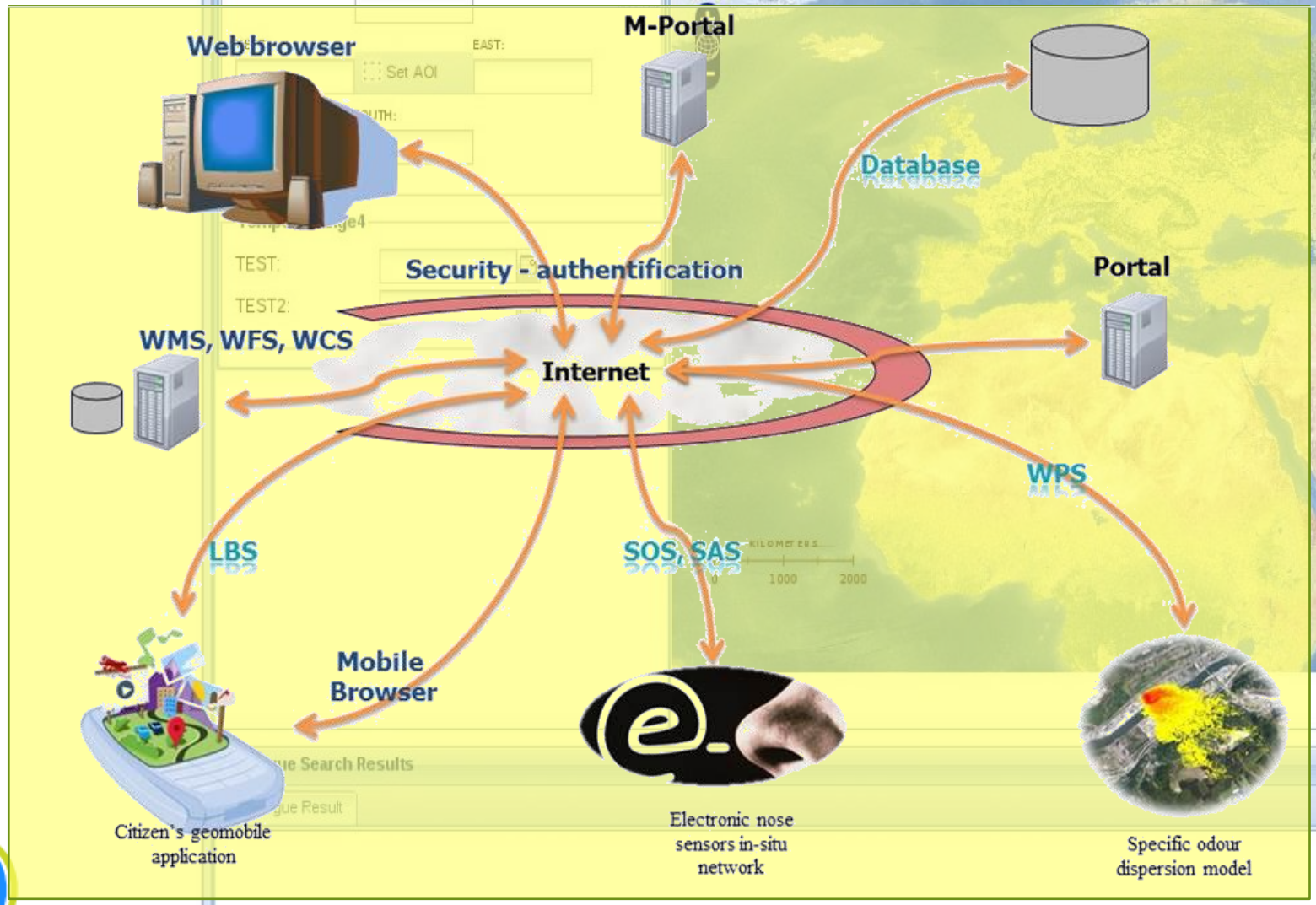
•

Odour = perception

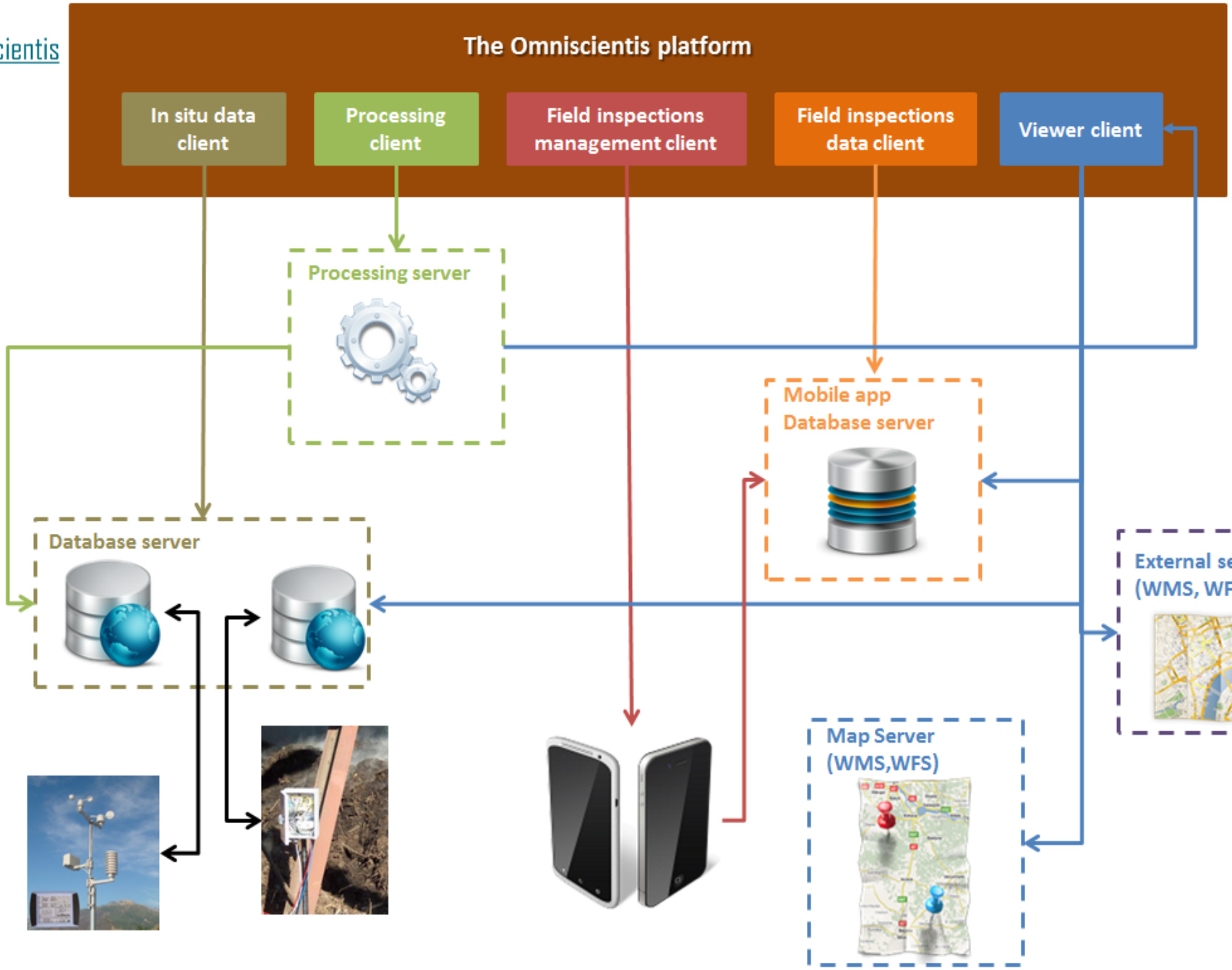
•

Citizens =
« victims » or « passive » observatories

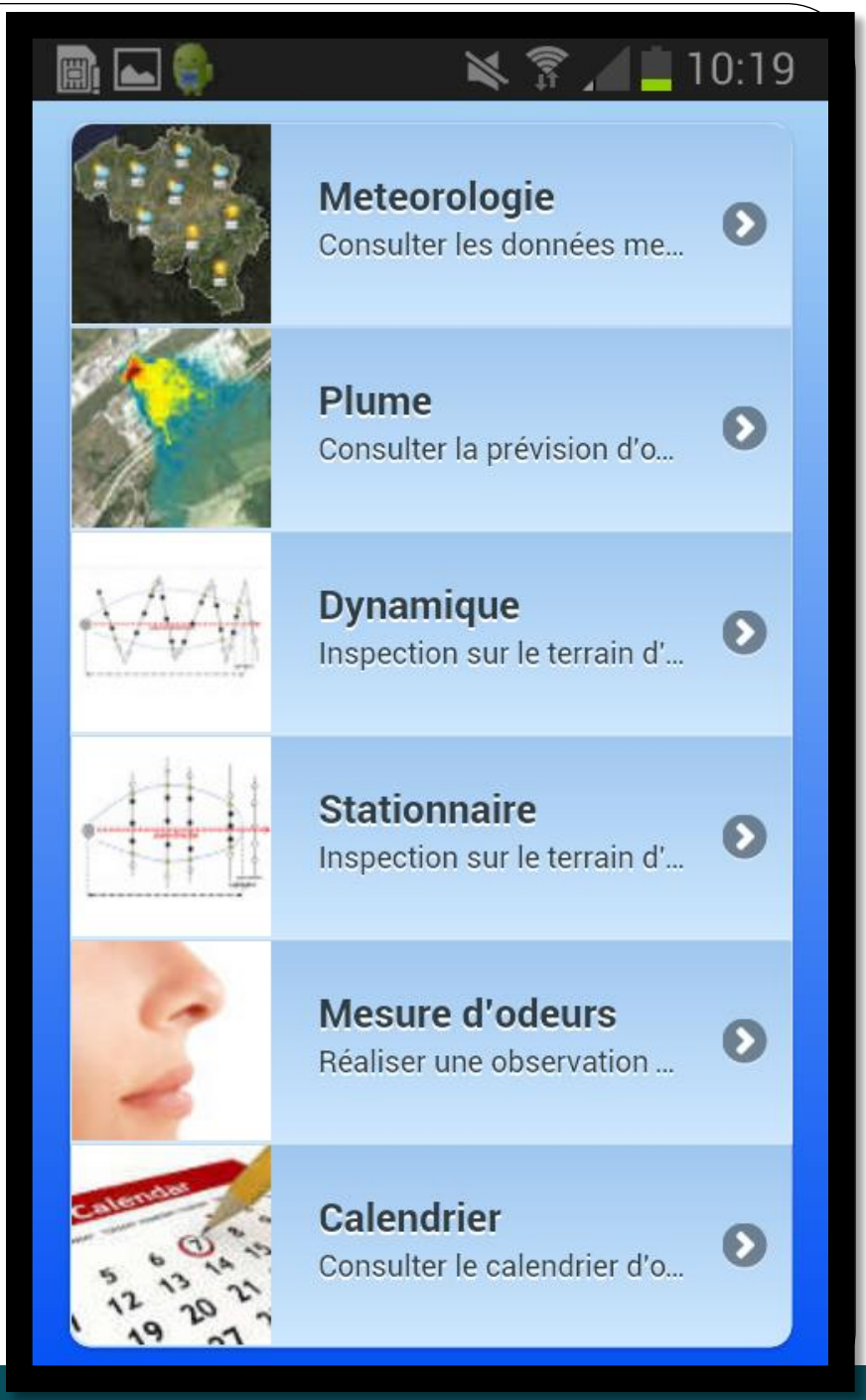
2. The web-based platform: the heart of the information and monitoring system



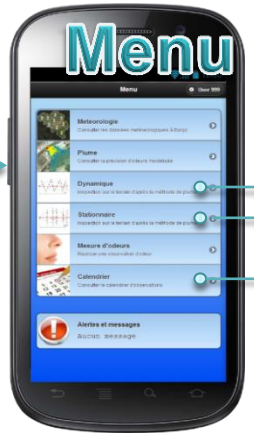
Omniscientis


The Omniscientis platform
In situ data client
Processing client
Field inspections management client
Field inspections data client
Viewer client
Processing server
Mobile app Database server
Database server
External server (WMS, WFS)
Map Server (WMS,WFS)

3. The geomobile application




Login
Accès utilisateurs
Observation anonyme


Menu
Météorologie
Plume
Dynamique
Stationnaire
Mesure d'odeurs
Calendrier
Alertes et messages


Field inspection dynamic


Observation form
Odeur:
Absence
Présence
Type d'odeur:
Chou
Pipi de chat
Gaz
Soufre
Produits chimiques
Autres
Intensité:
Basse
Intense
Très intense
Constance:
Shots
Constant
Commentaires/ Remarques
Envoyer


Registry


Field inspection static


Multiple observations form
Stop
Temps restant
8 s
Observation
1
Absence
Présence


Anonymous observation
A cocher si enrhumé
Intensité:
Basse
Intense
Très intense
Type d'odeur:
Chou
Nuisance:
Pas de nuisance
Intense
Très intense
Commentaires/ Remarques
Envoyer

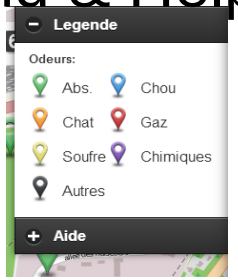

Calendar
August 2013

OMNISCIENTIS
(308427)

Zoom
in/out
+
PAN

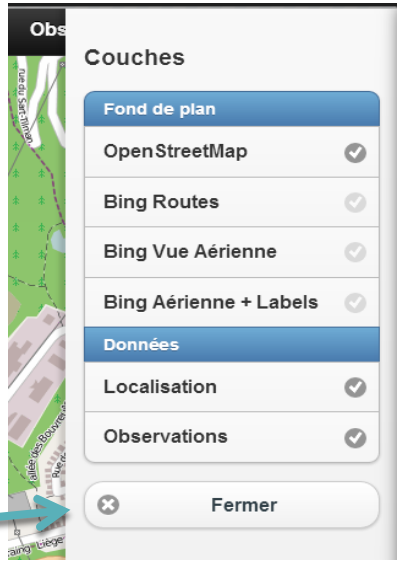
Options

Legend & Help



Chrono

Details



Automatic geolocation:

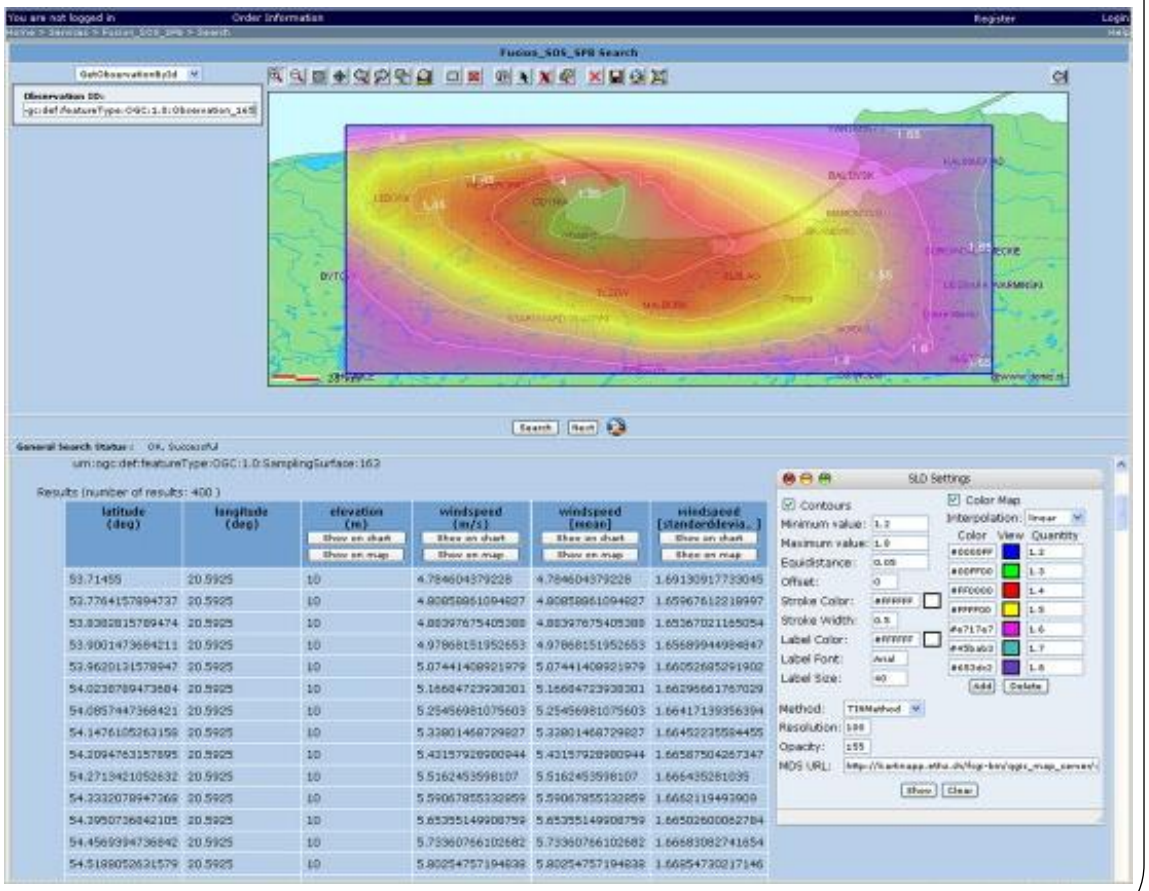
GPS, WiFi or network, best option available.
User can also locate himself manually (double tap)

Layers:

Active/deactive WMS base layers and vectorial layers

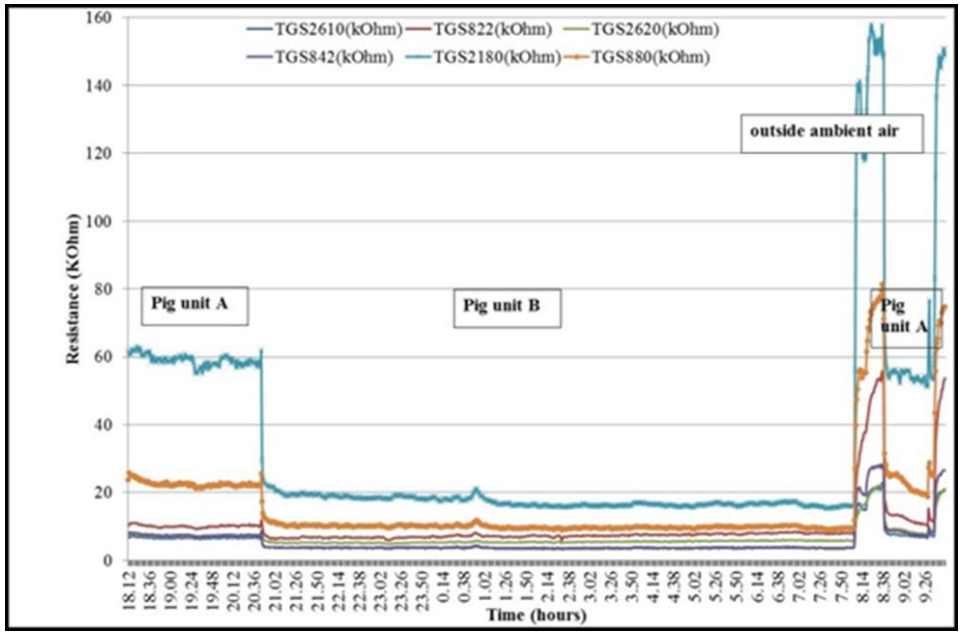
4. The e-noses as in-situ sensors

- **SOS :** Sensor Observation Service
- **SAS :** Sensor Alert service



Austria
Pig Farm

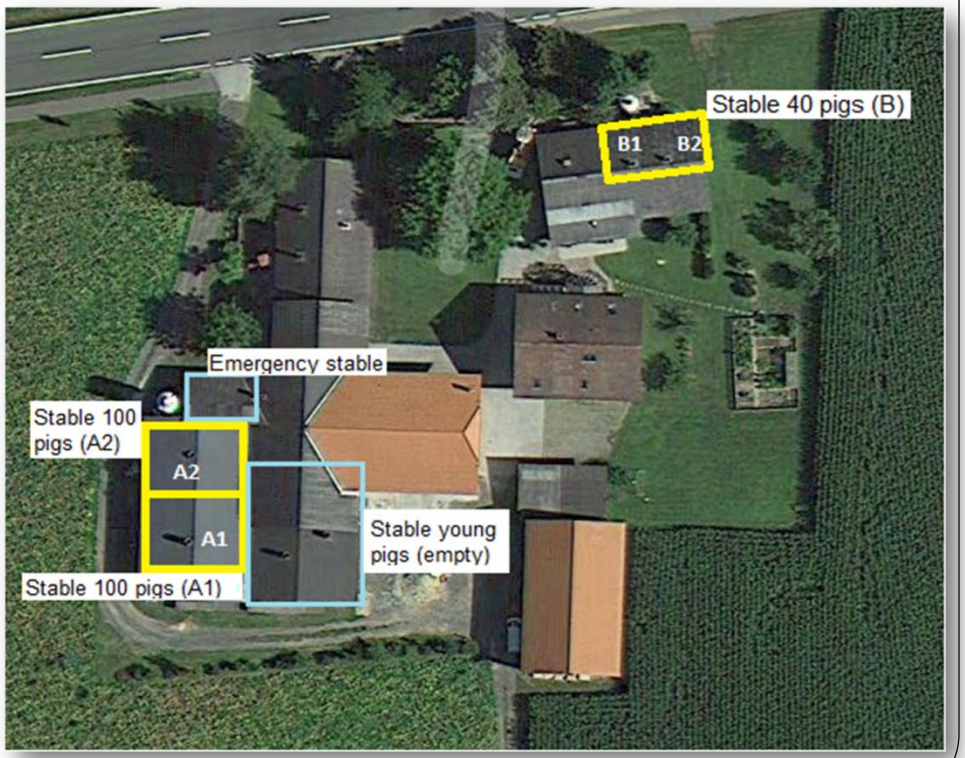
OMNISCIENTIS
(308427)



Real time monitoring e-nose's signals

	A (100 pigs. 90kg)	B (40 pigs, 100 kg)
Odour concentration average (uo_E/m^3)	6917 (in the stack)	3252
NH_3 concentration (ppmv)	30	10
H_2S Concentration (ppmv)	0.5	0.6
Flow rate (m/s)	1.2	Ventilation off
Temperature (°c)	20.4	17.3

Odour results in the pig farm

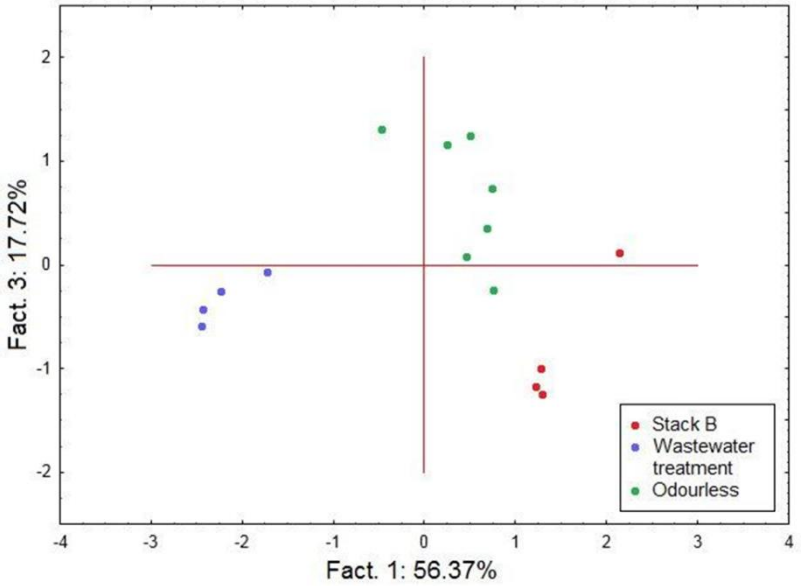


OMNISCIENTIS
(308427)

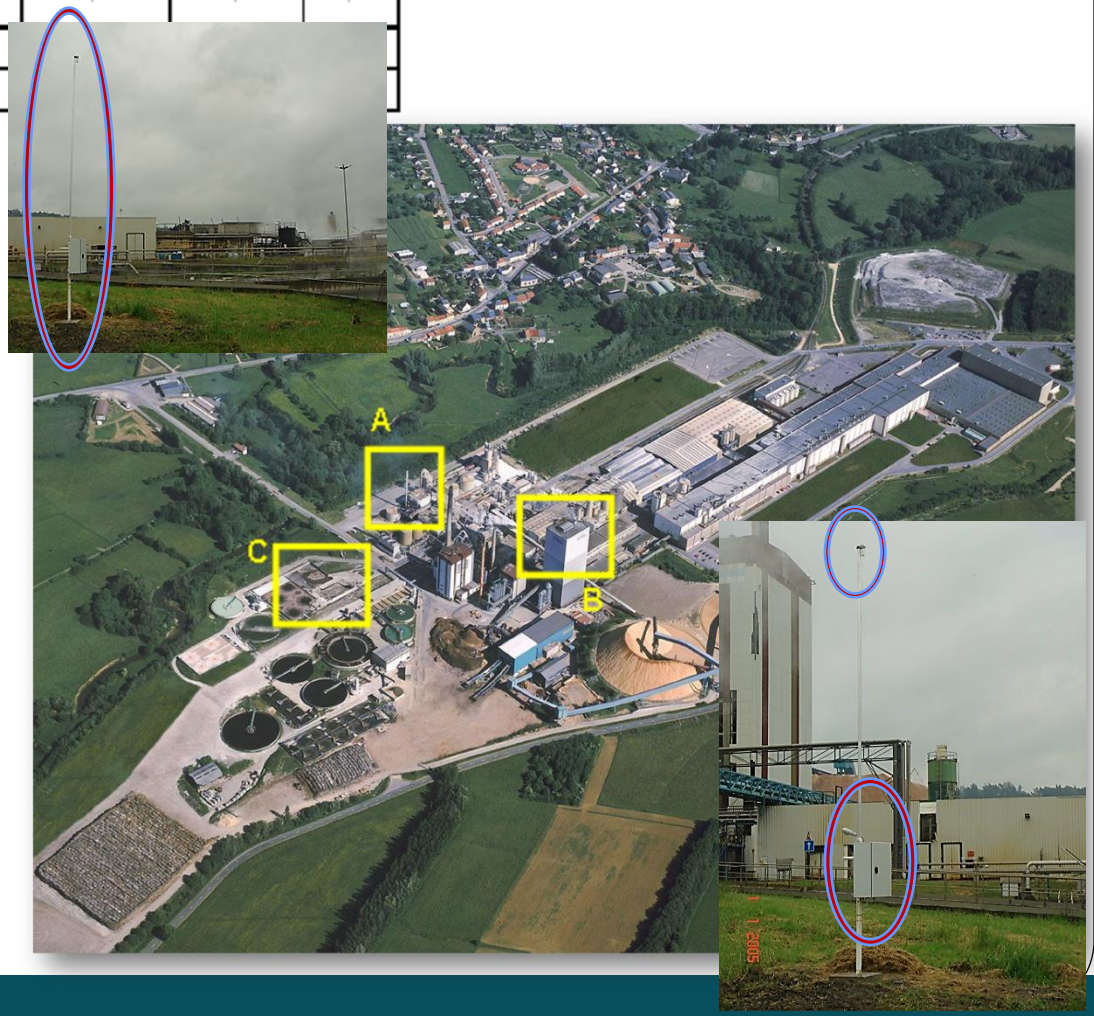
Source	Time	Odour concentration (uo_E/m^3)	Odour rate (uo/s)	Process variables				
				O2 (%)	NOx (mg/Nm^3)	SO_2 (mg/Nm^3)	TRS (mg/Nm^3)	Temp (°C)
Stack 1	6/3/2013 13h35	2373	198204	4	200.2	0.7	0.3	160
	14/3/2013 11h30	14201	1221121	2.5	165.9	0.6	0.3	162.6
Stack 2	6/3/2013 11h	4029	65873	8.8	83	53.5	36.9	194.9
	16/04/2013 11h20	3612	39028	/	/	/	/	/
wastewater treatment	14/3/2013 10h20	409961	676151					
	16/04/2013 10h10	63100	1032458					

Belgium
Pulp & Paper Mill

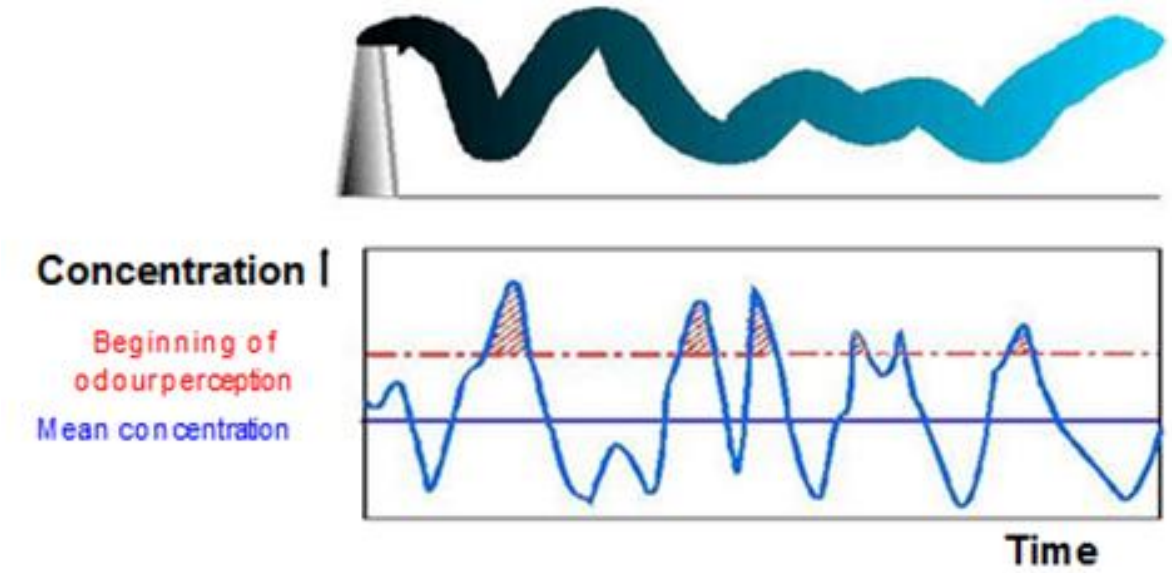
Odour data set measured in an industrial site



Principal component analysis for three different odour types

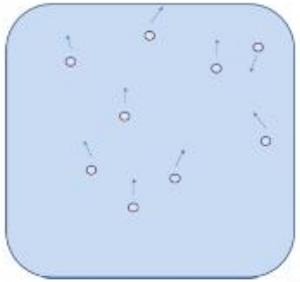


5. The specific odour dispersion model

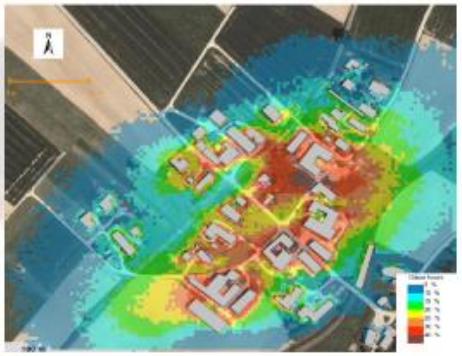


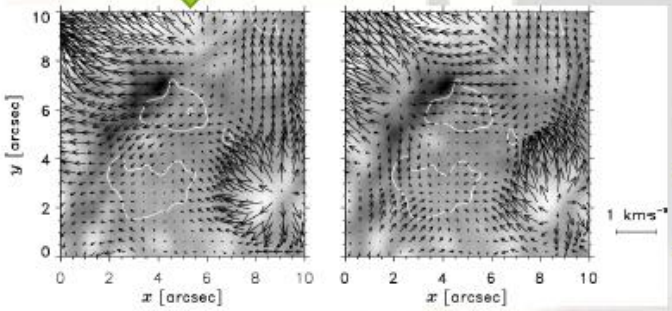
- Peaks above the perception level cause annoyance
- Air quality models and concepts used 30-60 min inputs data
- → need to represent the peaks with new specific odour dispersion model
  - Algorihtms – new turbulence parametrisations
  - Calculation on GPU

GRAL: A Lagrangian Dispersion Model



$$\begin{cases} x(t_2) = x(t_1) + \int_{t_1}^{t_2} u[x(t), t]dt \\ u_e = \overline{u} + u' \end{cases}$$

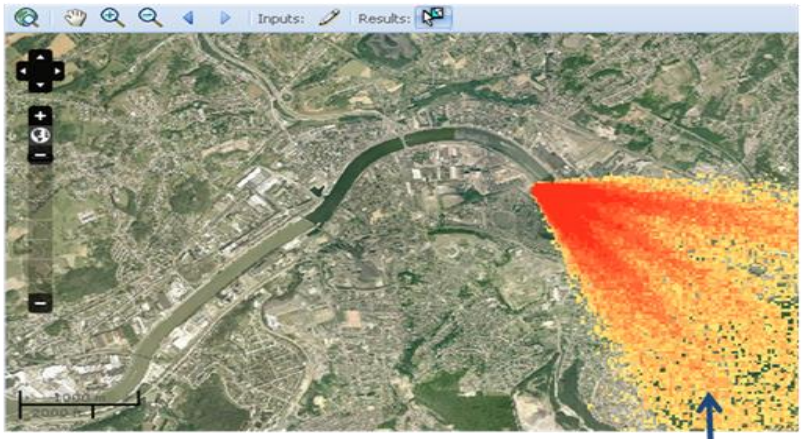




- **WPS**: Web Processing Service
- **WMS :**Web Map Service

1. The user (expert) sends a request including variable inputs to execute a process
2. The WPS launches the pre-treatment script
3. The pre-treatment script collects the observations coming from E-nose and meteorological databases for a selected time period
4. The pre-treatment script delivers variable inputs in the correct format (ASCII files)
5. The WPS runs the model and provides a ASCII grid (output)
6. The WPS creates a WMS layer thanks to a map server
7. The WPS sends the status of the process (including the url of the WMS) and the result (WMS layer) is displayed in the viewer

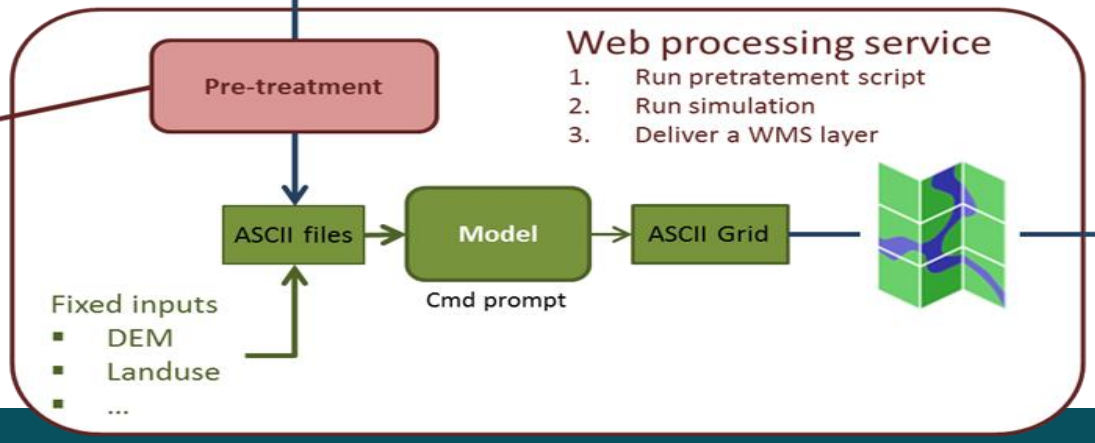
Web Platform

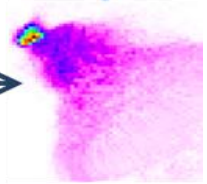


Variable inputs (in situ data):

- E-nose
- Meteorological data
- Emission
- x,y,z (?)

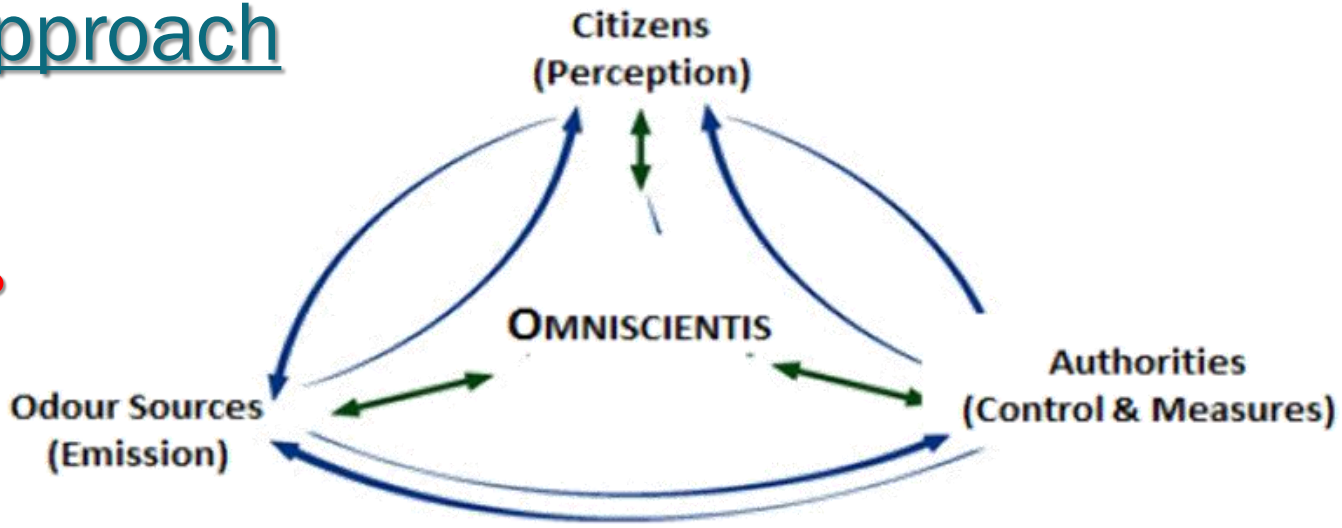
1. Get observations (E-nose and meteorological databases)
2. Deliver variable inputs in the correct format (ASCII files)





6. A Living lab Approach

Not only technically driven solutions but also socio-scientific approaches

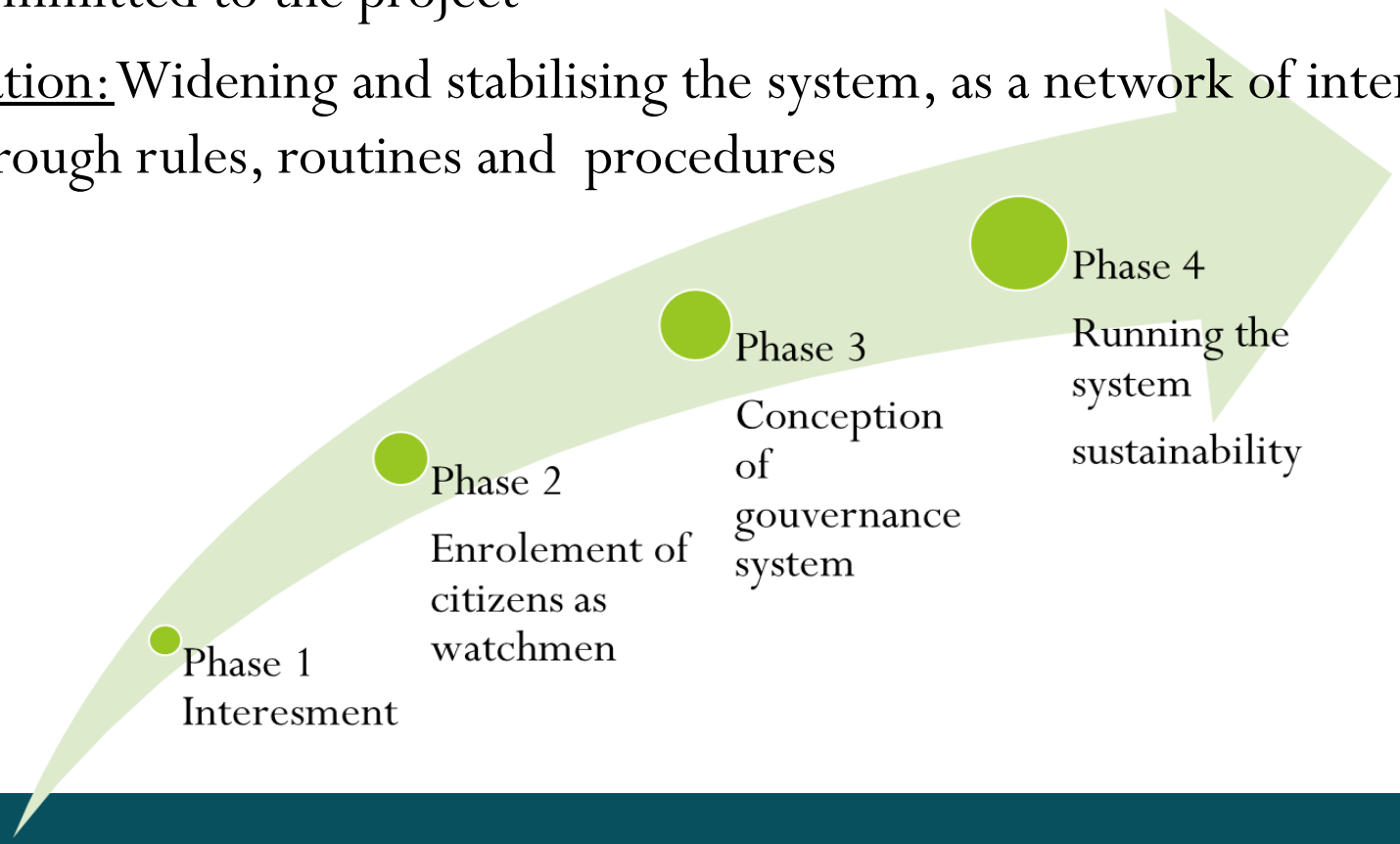


- a user-driven innovation ecosystem
- a business – citizens – government partnership
- an active part in the research, development & innovation process
- creative process
- bridging the innovation gap / uptake of new products and services
- early assessment of the socio-economic implications

A progressive approach :

Actor Network Theory (sociologie de la traduction) proposes a framework to understand the progressive consolation of a system:

- Interesment: Interesting and integrating the different actors in the process
- Enrolment : Enrolling them into specific roles, as they define and negotiate them, getting committed to the project
- Consolidation: Widening and stabilising the system, as a network of interacting actors, through rules, routines and procedures



7. The benefits of the Information System and Odour Monitoring

- **For Citizens** = "Give a voice to neighbours"
  - enhance, facilitate and structure bi-directional communications (including feedbacks)
    - allow industrials to inform the citizens if some process parameters are drifting and, in the other direction, it allows citizens to alert the plant manager if they observe odours in the neighbourhood.
  - citizens act as human sensors
  - provides appropriate tools to support campaigns of measurements via Geo-mobile applications
  - In-situ sensors provide quantitative measurements to objectivize complaints

Nuisance mitigation

7. The benefits of the Information System and Odour Monitoring

- **For industrials, farmer, … (source of nuisance) =**

  "Objectivize acceptation and limits of nuisances caused by their activities and enhance processes"

  - contributes to understand better the relation between emissions and odours observed in the surroundings.
  - Electronic noses and fast modelling capacities allow getting better information on the time behaviour of sources.
  - allows getting quick feed-back and alert from the citizens.
  - Reduces costs link of mitigation systems (masking products, Coal filter, …) thanks to a better tuning of the processes

7. The benefits of the Information System and Odour Monitoring

- **For experts :**
  - get detailed information on the time-behaviour of odour sources
  - facilitate measuring campaigns as described in new European standards from CEN TC 264/WG 27
  - fast and specialized odour dispersion models can be used to provide forecasting under expected meteorological conditions and/or compute yearly mean exposure frequencies

7. The benefits of the Information System and Odour Monitoring

- **For public authorities :**
  - benefit by getting a faster and more detailed understanding of odour observations around a source of nuisance
  - help defining commonly agreed limit values, based on objectively measurable exposure values
  - provide pertinent information for regulation definition or adaptation
  - Provide structured and objectivized information about odour nuisances and complaints link to them

8. Conclusions and perspectives

- Environmental information system serving:
  - Empowerment of the citizens in environmental monitoring and their active participation to environment management
  - a better understanding of odour perceptions in order to mitigate the nuisances

SEVENTH FRAMEWORK PROGRAMME
OMNISCIENTIS (308427)

OMNISCIENTIS

Invitation to the 1st Users' Workshop

October 7th 2013 ◆ Arlon (Belgium)

Please see www.omniscientis.eu

You are kindly invited to participate to the first users' workshop organized by the OMNISCIENTIS project (FP7-ENV-2012 Grant Agreement 308427).

Thank you for your attention

1 SPACEBEL
2 ODOMETRIC
3 KTT-iMA Kunz Technologie Transfert - Richter & Röckle
4 Université de Liège
5 TU Graz Graz University of Technology
6 APS TECHNOLOGY
7 tudor PUBLIC RESEARCH CENTRE HENRI TUDOR
BURGO ARDENNES
iew