# Introduction to SANY (Sensors Anywhere) Integrated Project

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**Abstract**

Sensors Anywhere (SANY) is an FP6 IST-5 Integrated Project dealing with sensor networks research for environmental applications. It aims to contribute to joint European Commission (EC) and the European Space Agency (ESA) "Global Monitoring for Environment and Security" (GMES) initiative by improving the interoperability of in-situ sensors and sensor networks, and allowing quick and cost-efficient reuse of data and services from currently incompatible sources in future environmental risk management applications.
This ambitious goal shall be achieved by (1) specifying a (generic) standard open architecture for fixed and moving sensors and sensor networks capable of seamless "plug and measure" and sharing (virtual networks); (2) developing and validating re-usable data fusion and decision support service building blocks and a reference implementation of the architecture; (3) closely working with end users and international organisation in order to assure that the outcome of SANY contributes to future standard(s) applicable to GMES.
All SANY architecture specifications shall be publicly available, validated by experts through OGC technical committee and compatible with EU and ESA infrastructure initiatives, such as Infrastructure for Spatial Information in Europe (INSPIRE; standard interfaces with geospatial information).
Last, but not the least important, SANY specifications shall be realised in three innovative risk management applications covering the areas of air pollution, marine risks and geo hazards.

## 1. At a crossroad

Environmental monitoring and risk management in Europe were historically considered as internal affair of each country, and usually in the inherence of local authorities. Resulting patchwork of incompatible semantic and information systems is still a prominent characteristic of environmental monitoring networks today.

However, times are changing. With initiatives such as Water Framework Directive (EC 2000), GMES (EC 2001, http://www.gmes.info/), and INSPIRE (http://www.ec-gis.org/inspire/), European Union is pursuing an ambitious agenda that gradually forces the member states, and the neighbouring countries to develop integrated or at least interoperable environmental monitoring networks and applications. In addition, several EU directives, including the "Directive on the freedom of access to information on the environment" (EC 1990) and the „Directive on the re-use of public sector information" (EC 2003) are putting

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public authorities under pressure to allow re-use of data (and particularly information on the environment) gathered using taxpayers money at a reasonable cost, preferably free of charge, to all interested parties.

SANY IP will help to speed up the existing trend towards standardized and interoperable environmental monitoring networks by developing the standards proposals covering the architecture and the interfaces of sensor networks for the domain of environmental risk management (and potentially for other domains), and implementing an on-demand environment to access GMES information and services.

Figure 1 indicates the main areas in which SANY IP can contribute to GMES initiative, either directly, by developing in-situ sensor network services and generic fusion services, or indirectly through ORCHESTRA (http://www.eu-orchestra.org), SSE (http://services.eoportal.org/) and i-MARQ (http://www.imarq.info/) inheritance.

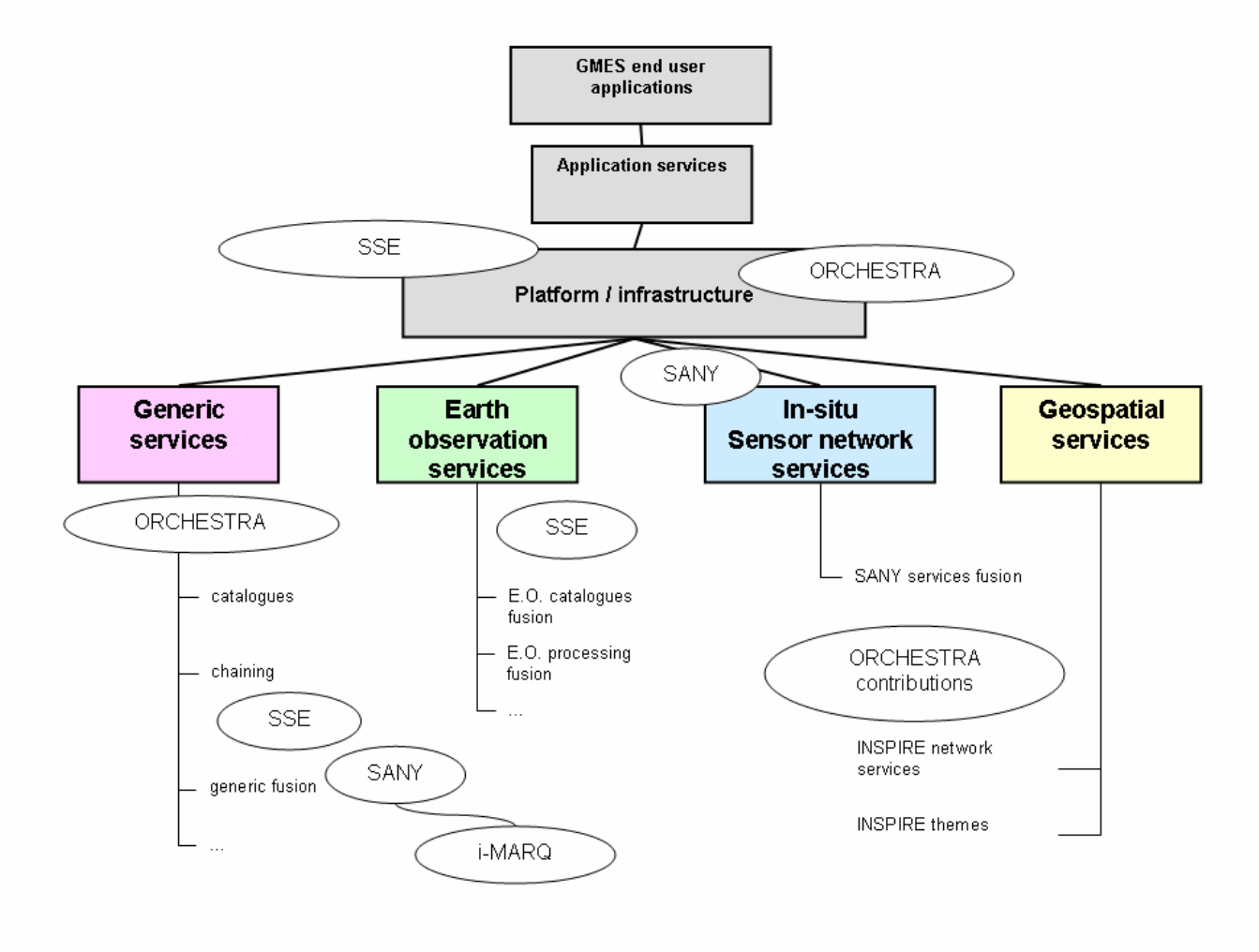


Figure 1
SANY long term vision

## 2. Project inheritance

In order to achieve the goal of promoting the standardization, rather than producing "Yet Another Monitoring Architecture", SANY IP will concentrate at *joining and merging existing successful approaches from past or on-going research projects as well experience and know-how of the contributing partners*.

In particular, SANY IP inherits and extends the results of ORCHESTRA IP and SSE (Services Support Environment), enriches them with additional generic fusion and DSS building blocks (services), and incorporates the benefits of upcoming Open Geospatial Consortium Sensor Web Enablement (OGC SWE; http://www.opengeospatial.org/functional/?page=swe) and the IEEE Standard on Smart Transducers (IEEE 1451; http://ieee1451.nist.gov/) in one comprehensive architecture. The most important relationships of SANY IP to existing and emerging work are shown in Figure 2. Less strong inheritance and indirect inheritance (e.g. the inheritance to INSPIRE which emerges indirectly through ORCHESTRA) are not shown.

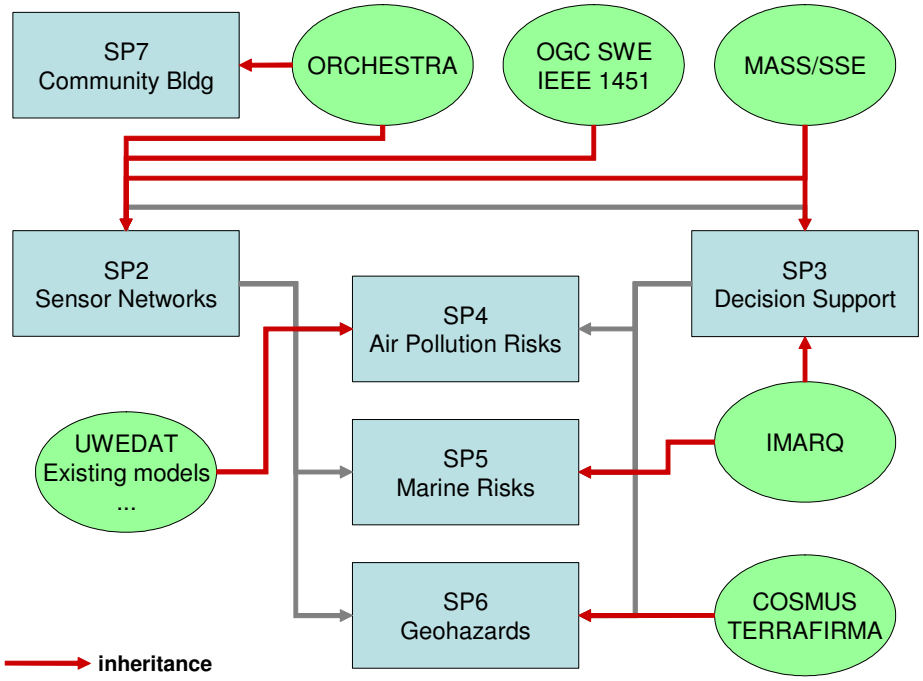


Figure 2
SANY project inheritance

On the *architecture and infrastructures level*, SANY starts from the following pre-existing work:

- the *well adopted approach of SSE*, which is an existing and operating infrastructure implemented by ESA to allow Expert Service Providers to benefit from a standardized infrastructure (a so-called Virtual Market place) in order to deliver cost-effectively to their customers services like flood damage assessment, crop monitoring and others, and which is representative of the platform for various GMES initial services;

- the on-going *architecture work of ORCHESTRA*, an IP funded under FP6-IST Call 3, which has the goal to develop an open architecture for risk management in Europe; in particular, ORCHESTRA is amongst those projects which contribute to the specification of INSPIRE network services;
- the extensive RTD and specification work carried out in the *OGC Sensor Web Enablement Group.*

At the level of *fusion, decision support tools and environments*, SANY starts from the following pre-existing work:

- the *SSE platform*, which already offers a number of mechanisms needed to run a Decision Support System, such as an open service integration framework, a workflow management capability, standard interfaces compliant with current standards, and which will ensure the compatibility with spatial data standards;
- the *I-MARQ Fusion and Modelling Engine*, which pioneered a capability for integrating highly heterogeneous environmental datasets; this technology also allows stochastic and deterministic models to enrich sparse datasets and support some forecasting of environmental parameters;
- the *WaterFrame® product suite* of Fraunhofer IITB as a set of operational water information systems that supports decision makers in several German environmental agencies in the implementation of the European Water Framework Directive; it is based on a development framework that provides a series of generic and domain-specific query, data analysis, reporting and visualization functions in maps and diagrams as well as sophisticated (geo-)statistical processing capabilities (e.g. regionalisation of qualitative groundwater parameters).

At the level of *applications*, SANY starts from the following pre-existing work:

- air pollution risks: ARC Seibersdorf Research (AT) and Iséo (FR), as producers of monitoring networks, provide their *respective on-line monitoring systems* and real-time archives including the UWEDAT (Schimak 2003) system of ARC-SR, whereas KTT-iMA (FR) will provide and adapt air pollution models and model environments, based on technology of the models FITNAH (Richter & Röckle) and LASAT (Janicke 2005);
- marine risks: BMT Cordah (UK) brings *leading-edge expertise in models* such as PROTEUS (Sabeur and Tyler 2004) that forecast how pollutants behave in a dynamic marine environment; Recent advances in linear sensor networks, e.g. in the FP5 Ferrybox project (Petersen et. al. 2003) and ad-hoc, intelligent marine sensor networks using floating buoys can also be exploited through SANY;
- geo-hazards: Soldata (FR) will provide its *geo-hazard measurement environments, including the versatile Geoscope GIS & historical database suite* (http://www.soldatagroup.com) as a basis for additional modules and interfaces. At the level of geo hazards application, SANY will define users requirements in connection with public bodies but also with EU projects such as SAMCO (Structural Assessment Monitoring and Control; http://www.samco.org/). Technological choices and services implementation will take into account the conclusions of Geo-hazard monitoring projects such as SLAM (Farina et. al. 2004).

## 3. Users and applications

In order to avoid a common pitfall, which consists in ignoring the users and consequently producing the infrastructure that does not really help in building applications, SANY IP includes *three "validation" sub-projects*. These sub projects serve a dual purpose: first, assuring the SANY infrastructure and generic services are usable for building the applications in three different (and unrelated) environmental domains, and second, building prototype applications which illustrate all capabilities of the new infrastructure.

### 3.1 Validation sub projects

The first validation sub project, which will illustrate the use of "plug and measure", vendor independence, and feasibility of building virtual networks across administrative and technical borders, shall concentrate on assessing the *air pollution* episodes, tracking the pollution back to its source, and predicting the air pollution in urban area or around an industrial zone.

The second validation sub project, which illustrates the full capabilities of the generalised fusion services, and the feasibility of using very different data sources (e.g. meteorological and metocean, sea temperature, turbidity, salinity, chlorophyll, dissolved oxygen, microbial concentration monitoring with buoys and ship-borne units, airborne surveillance, EO data, historic data, …) in a consistent way, shall concentrate on *coastal water management* questions, such as assessing, modelling, and predicting the bathing water quality with user determined what-if scenarios.

Finally, the third validation sub project, which illustrates the integration of the SensorWeb pods into SANY networks, rapid deployment, auto-configuration and self-management shall concentrate at *geo hazards* monitoring in a complex urban case, and assessing the structural instability of architectural objects caused by human activities (e.g. building a metro line) and natural causes.

### 3.2 Controlling committee

In order to assure the service providers interests aren't "forgotten", three service providers (one per validation sub project) are actively participating in the project. These are the:

- Austrian Umweltbundesamt (AT), the *expert authority for environmental protection and environmental control of the Austrian federal government*, responsible for environmental monitoring (air, water, etc.) in Austria participates in the "air pollution" sub project;
- Maritime Office in Gdynia (PL), a *government authority responsible for monitoring the safety, security, and environmental risks in Polish territorial waters* participates in "Coastal water management" sub project;
- Gestió d'Infraestructures S.A (SP), a public company created by the Generalitat de Catalunya in 1990 whose purpose is contracting, building, maintaining and producing public works of all kinds, including the geo-monitoring programs, participates in "Urban geo hazards" sub projects.

The main role of these three partners is to assure that SANY specifications and applications are compatible with the real needs of the service providers, e.g. through requirements analysis and evaluation of the SANY infrastructure and respective validation sub projects.

## 4. How to get involved

SANY IP is actively seeking the possibilities to build an active dialogue with end users of environmental data, service providers and service developers interested in the abilities of the SANY technology. Currently, the Consortium is particularly interested in input concerning the following themes:

1. Developing a set of use cases that illustrate various real world scenarios where SANY technology can bring measurable advantage to developers, end users or service providers, or even allow building applications that are virtually impossible using state of the art technology. In particular, SANY IP is interested in additional use cases that illustrate the advantages of self configuration, rapid deployment and advanced data fusion, as well as all use cases involving combinations of moving, roving, high altitude and EO sensors.
2. Cross checking of requirements with developers and service providers of environmental sensor networks, as well as with end users of environmental data.

All parties interested in providing input on above mentioned themes, other types of collaboration with SANY IP, or further information about the project are kindly asked to contact the Project Coordinator or one of the project partners. A list of all project partners with contact details can be found on SANY IP web site (http://sany-ip.eu).

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