

## Web-based data information system



## Motivation

Access to marine data is of crucial importance for marine research and a key issue for various studies, from climate change prediction to off shore engineering. Giving access to and harmonizing marine data from different sources could help industry, public authorities and researchers to find the data and to make more effective use of them, in order to develop new products, services and to improve our understanding of how the seas behave. Sharing observed data benefits everyone: changes in one country's waters affect those of its neighbors. National data alone are not sufficient to improve our knowledge on the sea as a European and global system connected by shifting winds, seasonal currents etc. In this context, the SCHeMA data portal infrastructure provides a series of interface features that allows users to discover and access all the data and metadata registered by the SCHeMA integrated mapping probes in a standard way compliant with major European Directives and recommendations for data interoperability.

## SCHeMA System Architecture

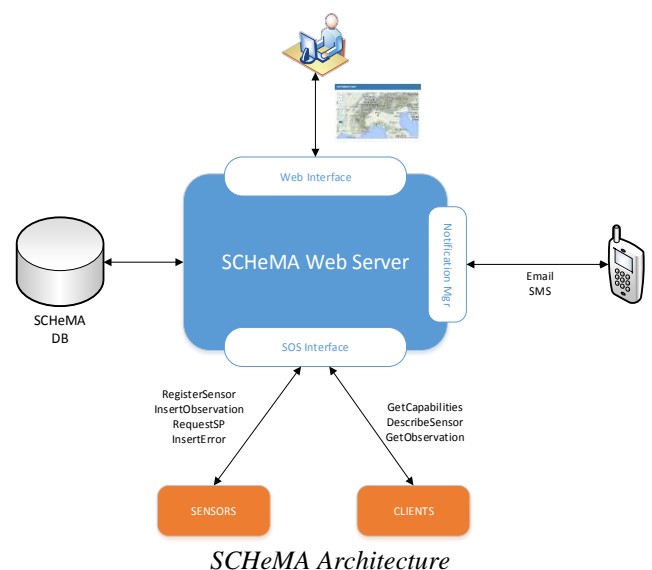
The SCHeMA web based data information system architecture is composed of four main modules:

**SOS Interface:** web service interface that implements the OGC-SOS standard (v.1.0) that enables (i) data producers (the SCHeMA submersible probes) to register themselves to the system and to send its collected observation and (ii) data consumers (users, client applications) to discover and retrieve data and metadata on SCHeMA probes and observations.

**Web Interface:** user front-end to access from the web all the information stored in the SCHeMA system.

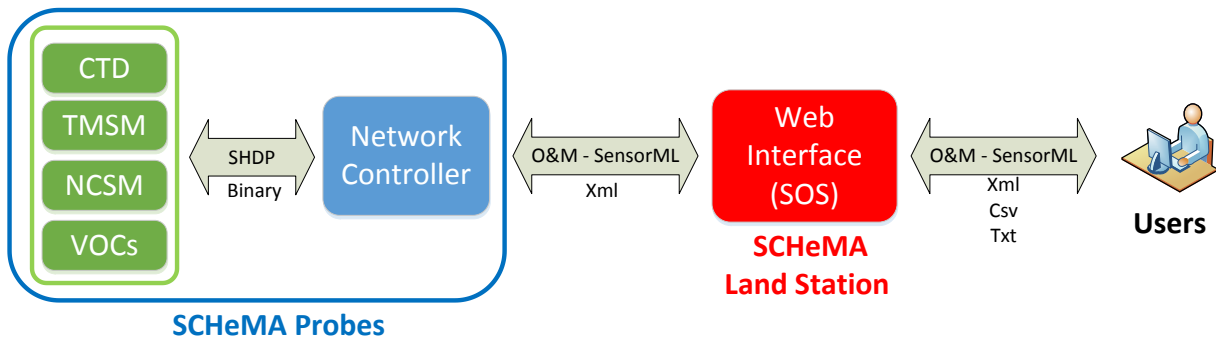
**Notification Manager:** application that manages the alarms notification to the users.

**Database:** the RDBMS where the data are stored. It is based on Microsoft SQL Server 2012 R2.



## SCHeMA Sensor Observation Service

The SCHeMA Communication Protocol is modelled implementing the Sensor Observing System (SOS) standards in order to provide easy access and full interoperability with other systems and sensors. A Network Controller is the transducer of the information sent by the in situ integrated mapping probes to a Land Station that hosts and makes available all the data (web user and machine to machine) for interoperability and accessibility. The Land Station provides the user (i.e. the SWE client) with the registries (catalogue) with metadata for the different types of sensors and the kind of data they are capable of providing.



SCHeMA SWE diagram. The submersible mapping system is managed by the Network Controller that handles all the communication with the CTD (Multi-parameter submersible probe), TMSM (Trace Metals Submersible Module), NCSM (Nutrient, Carbonate and algae Submersible Module) and VOC (Volatile Organic Compounds) modules.

In order to guarantee full interoperability with other monitoring systems and catalogues, sensor metadata are encoded using Sensor Model Language (SensorML) standard while sensors observations are encoded through Observation & Measurements (O&M) standard.

### SCHeMA Web Data Portal

The SCHeMA web user interface (WUI) is the SCHeMA system front-end and it allows the user to manage the probes/sensors, view the stored observations and metadata, handle alarms and access remotely the sensors configuration features. Some of the features are restricted to SCHeMA users and the SCHeMA WUI is running a specific module to manage user authentication and user rights.

The web interface is developed in ASP.net 4.5, C# and Bootstrap framework (<http://getbootstrap.com>), data interaction is provided by the Entity Framework 6.1 (<http://msdn.microsoft.com/it-it/data/ef>), while plots are displayed by using methods from the HighCharts library <http://www.highcharts.com>.

The screenshot displays the SCHeMA Web User Interface. It features a sidebar with navigation options: Experiments, Sensors, Alarms, Sensor Planning, Service, and Data Access. The main content area includes an 'EXPERIMENTS MAP' showing a map of Europe with several experiment locations marked. To the right of the map are four summary cards: 8 Sensors, 4035 Observations, 6 Experiments, and a last observation timestamp of 21/04/2016 15:01:24. Below the map is an 'EXPERIMENTS TABLE' with columns for Exp ID, Name, Sensors, Location, Position (Lat/Lon), Start date, Type, and Public status. The table contains 6 entries, with the first one being 'SCHeMA\_38M Field Test'.

Exp ID	Name	Sensors	Location	Position (Lat/Lon)	Start date	Type	Public
18	SCHeMA_38M Field Test	SCHeMA_NC, SCHeMA_CTD, SCHeMA_TMSM	StationCNR_Genova	44.396 / 8.931	19/04/2016 16:26:29	TS	✓
17	SCHeMA_CNRGenova_078316001_cas2	SCHeMA_CTD	StationCNR_Genova	44.396 / 8.931	07/03/2016 11:00:57	PF	✓
16	SCHeMA_CNRGenova_078316001_cas1	SCHeMA_CTD	StationCNR_Genova	44.396 / 8.931	07/03/2016 09:51:38	PF	✓
15	SCHeMA-1-2015	TMSM_OS316	Arcachon Bay	44.680 / -1.098	21/04/2016 12:00:00	TS	✓
14	Development test LUNGE IT umbi Genova	SCHeMA_NC, SCHeMA_CTD, SCHeMA_TMSM	StationCNR_Genova	44.396 / 8.931	16/02/2016 12:23:03	TS	✓
1	Test 01	SCHeMA1_IDRO, SCHeMA1_TMSM, SCHeMA1_NC	brughiero	45.320 / 9.170	22/06/2015 14:12:58	TS	✓

SCHeMA Web User Interface

User-friendly data discovery, access and download as well as interoperability with other projects are achieved via dedicated interface compatible with INSPIRE and GEO/GEOSS standards and principles.

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