ENERGIC OPEN DATA

European NEtwork for Redistributing Geospatial Information to user Communities - Open Data

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ENERGIC OD

European NEtwork for Redistributing Geospatial Information to user Communities - Open Data

D6.1 APPLICATION BASED REQUIREMENTS AND STANDARDS CATALOGUE (SECOND RELEASE)

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Authors	Stefan Braumann (LUP), Helga Kuechly (LUP)
Contributors	Stefan Braumann (LUP), Helga Kuechly (LUP), Raffaella Brumana (POLIMI), Mattia Previtali (POLIMI), Paula Iden (SRP), Tino Desjardins (SRP), Michael Müller (AED-SICAD), Matthias Rüttinger (AED-SICAD), Ralf Roscher (AED-SICAD), Ralph Pfannkuche (AED-SICAD), Thomas Portier (DEPTH), Olivier Frezot (BRGM), Olivier Bedel, (ALKANTE), Pawel Kwiatkowski (IGIK), Miguel Ángel Latre Abadia (UNIZAR), Rodolfo Rioja (UNIZAR), Erwan Bocher (CNRS), Gwendall Petit (CNRS), Nicolas Fortin (CNRS)
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[1] R = Report, P = Prototype, D = Demonstrator, O = Other

[2] PU = Public, PP = Restricted to other programme participants (including the Commission Services), RE = Restricted to a group specified by the consortium (including the Commission Services), CO = Confidential, only for members of the consortium (including the Commission Services).

ENERGIC OD Consortium

National Research Council of Italy (CNR-IIA)
Italy

AED-SICAD Aktiengesellschaft (AED-SICAD)
Germany

Association Francaise pour l'Information Geographique (AFIGEO)
France

Bureau De Recherches Geologiques et Minieres (BRGM)
France

Alkante Sas – Geonet (ALKANTE)
France

Centre National de la Recherche Scientifique (CNRS)
France

Depth France Sas (DEPTH)
France

Verband der GeoInformationswirtschaft Berlin/Brandenburg (GEOkomm)
Germany

Instytut Geodezji i Kartografii (IGIK)
Poland

Luftbild Umwelt Planung GmbH (LUP)
Germany

Politecnico di Milano (POLIMI)
Italy

Gesellschaft für Stadt-und Regionalplanung mbH (SRP)
Germany

Regione del Veneto (VEN)
Italy

Trilateral Research Ltd. (TRI) - United Kingdom

Universidad de Zaragoza (UNIZAR)
Spain

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Table of Contents

Index of Figures

Index of Tables

Abbreviations and acronyms

Abbreviation / Acronym	Description
AOI	Area of interest
API	Application Program Interface
APP	Application or service
ArcGIS	Geographic information system and similar solutions by the Environmental Systems Research Institute
ASCII	American Standard Code for Information Interchange
AVHRR	Advanced very-high-resolution radiometer instruments are a type of space-borne sensor that measure the reflectance of the Earth in five spectral bands (carried by the US National Oceanic and Atmospheric Administration).
BBI	Biodiversity Bird Indicator
CA	Consortium Agreement
CIP	Competitiveness and Innovation Framework Programme
Copernicus	Programme of the European Commission for Global Monitoring
CRS	Spatial Reference System
CSS	Cascading Style Sheets
CSV	Comma-separated values file format
CSW	OGC Catalogue Service for the Web
DB	Data base
DjVu	File format for scanned documents
DoW	ENERGIC OD Description of Work
E.L.F.	European Location Framework
EB	Executive Board
EC	European Commission
ENERGIC OD	European NEtwork for Redistributing Geospatial Information to user Communities- Open Data
Esri	Environmental Systems Research Institute
EU	European Union
FTP	File Transfer Protocol is standardized and enables the transfer of data files per web.
GA	General Assembly
GDI-DE	Geodateninfrastruktur Deutschland
GeoJSON	Open standard format for geographical information (see JSON)
GeoTIFF	public domain metadata standard which allows georeferencing information to be embedded within a Tagged Image File Format (TIFF) file
GI	Geoinformation
GIS	Geographic Information System
GML	Geography Markup Language
GPS	Global Positioning System
GrAg	Grant Agreement
GSM	Standard for mobile phones: "Global System for Mobile Communications"
GUI	Graphical user interface
HistMapsZGZ	Zaragoza Historical Maps
HTML	Hypertext Markup Language
HTTP(s)	Hypertext Transfer Protocol

IDEZar	Infraestructura de Datos Espaciales de Zaragoza (Zaragoza Spatial Data Infrastructure)
IEEE	Institute of Electrical and Electronics Engineers
INSPIRE	Infrastructure for Spatial Information in the European Community
iOS	Mobile operating System by Apple Inc.
ISO	International Organization for Standardization
JDBC	Java Database Connectivity
JPEG	Raster file format
JPEG2000	Raster file format
JS	JavaScript
JSON	JavaScript Object Notation
KML	Keyhole Markup Language
LDAP	Lightweight Directory Access Protocol
NGO	Non-Governmental Organisation
NSDI	National Spatial Data Infrastructure
OD	Open Data
ODP	Open Data Portal
OGC	Open Geospatial Consortium
OS	Operating System
OSH	Open Sensor Hub
OSM	OpenStreetMap
OVH	Internet Service Provider
PBF	Protocolbuffer Binary Format
PC	Project Coordinator
PDF	File format and acronym for Portable Document Format
PHP	server-side programming language
PNG	Raster file format
PO	Project Officer
POI	Point of interest
QGIS	Quantum GIS
REST	Software architecture style: "Representational state transfer"
SDI	Spatial Data Infrastructure
Sensor ODP	Sensor Open Data Portal
SHP	File format for spatial vector data by the Environmental Systems Research Institute
SOA	Service-oriented infrastructure
SOAP	Simple Object Access Protocol
SOS	Sensor Observation Service, an OGC standard to share sensor data measurements using web services.
SOS-T	Transactional Sensor Observation Service
SQL	Structured Query Language
SSAA	Server-side analysis application of the Biodiversity Bird Indicator.
SWE	Sensor Web Enablement, a set of OGC standardized web services to automate sensor data manipulation and sharing through the web (e.g. SOS...).
UC	Use Case
UI	User interface
UML	Unified Modelling Language
URL	Uniform Resource Identifier

VH	Virtual Hubs
VH-ES	ENERGIC OD Spanish Virtual Hub
VH-PL	ENERGIC OD Polish Virtual Hub
W3C	World Wide Web Consortium
WCAG	Web Content Accessibility Guidelines
WFS	Web Feature Service
WMS	Web Map Service
WMS-C	Web Mapping Service - Cached
WMTS	Web Map Tile Service
WP	Work Package
WPL	Work Package Leader
XML	Extensible Markup Language

Table 1: Abbreviations and Acronyms

EXECUTIVE SUMMARY

The development of new innovative applications making use of the Virtual Hubs (VHs) created within the ENERGIC OD project relies on certain requirements and standards. As part of the deliverable in Work package (WP) 6 the concepts, solutions, technical ideas, and expectations specific to their application were collected via two requirement questionnaires. This document summarizes the general and application specific requirements of all ten partner applications. The scope, user classes, use cases, interfaces with other systems, assumptions and constraints, the functional requirements as well as the behaviour of the application, the non-functional requirements, the geodata used, and the development of the environment for the implementation are discussed. They were completed considering the view of the user, developer, as well as the system and unit specifications. As the development status of each application differs widely and due to other constraints, some requirement details were not yet available.

All applications are based on a client-server architecture with common programming languages. The functional requirements are apart from application specific necessities similar in relation to the used geodata and their visualization within a geoportal. Some of these can be implemented at different points of the development stage and interfaces therefore inherit application based requirements. The non-functional requirements are less application specific and more general for all applications. Metadata of the datasets is a key requirement not only for the non-functional requirement but also to ensure quality standards within the thematic context of the application.

The spatial extent of most applications within the project is limited to a regional extent which also feeds back to the basic data requirements as well as necessary data projections. Finally, a key component of the automated data access from external data sources are established and known standards and protocols, e.g. OGC-standards, HTTPS and XML.

1 INTRODUCTION

As part of the project ENERGIC OD VHs and its use in applications will be developed. The aim is to achieve the greatest possible functionality and also low development efforts for the applications through the use of these VHs.

In total ten applications will be created by ten project partners. The project partners are from various European companies and institutions, covering both the public scientific as well as the private sector. Each application has its individual topic and is addressed to a specific user group. These applications are in different development stages with some existing applications that will be further enhanced within ENERGIC OD and others starting from scratch. Below, the individual project partners, their applications and the respective topics are described in more detail:

Participant	Title of application	Topic
UNIZAR	HistMapsZGZ	Historical Urban Development
AED-SICAD	eye2eye	Government
BRGM	Coastline Evolution Monitoring	Environment
CNRS-IRSTV	OnoMap!	Noise pollution
DEPTH	ProxiSanté	Healthcare
IGIK	Natural hazard assessment for agriculture	Agriculture-Hazards assessments
LUP	Biodiversity Bird Indicator	Agriculture-Environment
POLIMI	Geopan Atl@s	Urban development
SRP	GEO*demos*	Urban development / Government
ALKANTE	Sensor Open Data Portal	Provision of sensor data

Table 2: Application overview

The aim of this deliverable is to collect the requirements of the ten applications and to provide a point of reference for the developer view of the VH implementation.

2 METHODOLOGY

For the summary of the application based requirements two templates were created and provided to all participating partners. The first template (see Annex A) was made available in the second month of ENERGIC OD. This template sets the focus on following aspects to identifying the application requirements for each application, the:

- **scope,** describing the general background of the application
- **interface with other systems** to show the relation to external services and applications
- **assumptions** and **constraints** for conditions, which impact the application and its development
- **functional requirements** to describe the in- and outputs as well as the behaviour of the application
- **non-functional requirements** that state partial measurable features of the application
- **data requirements** for the entities and decomposition of data to be used

- **development** to show the environment, which will be used for the implementation of the application

All these aspects were taken into consideration of the users, the developers as well as the system and the unit-wide view of the application.

The second template (see Annex B) was provided in month 16 of ENERGIC OD, after the technical review meeting in month 15 and the decision to get a clearer and more objective definition of applications in order to reflect the requirements and specifications. In addition, this revision is used to specify the requirements of the new application by UNIZAR, which replaces the application “Geotraceability for food products” by NOW.

Therefore, the IEEE standard 830-1998 – “IEEE Recommended Practice for Software Requirements Specification” was used as an orientation for the second template. It includes a more detailed view on the application components and the related actors, especially the users of the applications. The approach to realise this intention was based on following steps:

1. Definition of the **system components** and the **user classes**
2. Specification of the **relation** between user classes and the application specific system
3. Identification of **use cases** and the related sequence of activities by involved user classes and system components
4. Specification of the features of the **operating environments** of the applications, which impact the application requirements
5. Derivation of the **application requirements** by the analysis of the objective of the use cases and the related activities by the system

As a result of the different development status and agreements with user groups as well as partner side internal constraints the received requirement descriptions are of different levels of detail, with missing information for some applications.

Based on the provided application specific information and the derived requirements a general survey of the application requirements was created.

For this purpose, the collected application specific requirements were broken down into content-related unambiguous and self-contained entities, standardized and summarized in tabular form as illustrated in **section 4**.

3 APPLICATION SPECIFIC REQUIREMENTS

This section presents the information provided by partners and the requirements specific to the application or service.

3.1 HistMapsZGZ (by UNIZAR)

3.1.1 Introduction

3.1.2 General Description

3.1.2.1 Product Perspective

Zaragoza Historical Maps (HistMapsZGZ) is a new application that will be integrated in the

Zaragoza SDI (IDEZar). The application will be included in their geoportal and will make use of their services, directly or by means of the ENERGIC OD VH-ES.

HistMapsZGZ will be also included in the application catalogue of the Zaragoza OD platform.

3.1.2.2 Product Functions

HistMapsZGZ aims at providing a visualisation tool to portray historical cartography from Zaragoza City from 1879 to 1986 that currently are available at the Zaragoza Open Data Platform in the form of raster files[3]. As additional historical maps are expected to be added, the application will retrieve the set of the offered historical maps from the Zaragoza Open Data Platform. The tool will also allow comparing the historical maps to the current cartography of the city, according to the maps provided by the Zaragoza SDI.

3.1.2.3 User Characteristics

3.1.2.3.1 User Classes

All the web applications the Council offers through its web portal are addressed to regular citizens. Nonetheless, from the description of the uses cases below, we can distinguish two kinds of users:

- Citizen: a regular user, with basic computer skills and a regular history background.
- Historian: a more advanced user, also with basic computer skills but more history background. The “browse all available historical maps” use case described below will be of more interest to this kind of users.

3.1.2.3.2 Relation of Users and System Components

Despite having established two kinds of users, no part of the application will have restricted access depending on the kind of user. It is expected that a citizen (regular user) will be more comfortable executing the part of the application corresponding to the “basic browsing of historical maps”, “comparing an historical map and the current one” and “viewing the evolution of a POI” use cases, and that the use case “browse all available historical maps” would be more interesting to historians, but any user could use the system in the same way.

3.1.2.3.3 Use Cases

[3] http://www.zaragoza.es/ciudad/risp/detalle_Risp?id=29

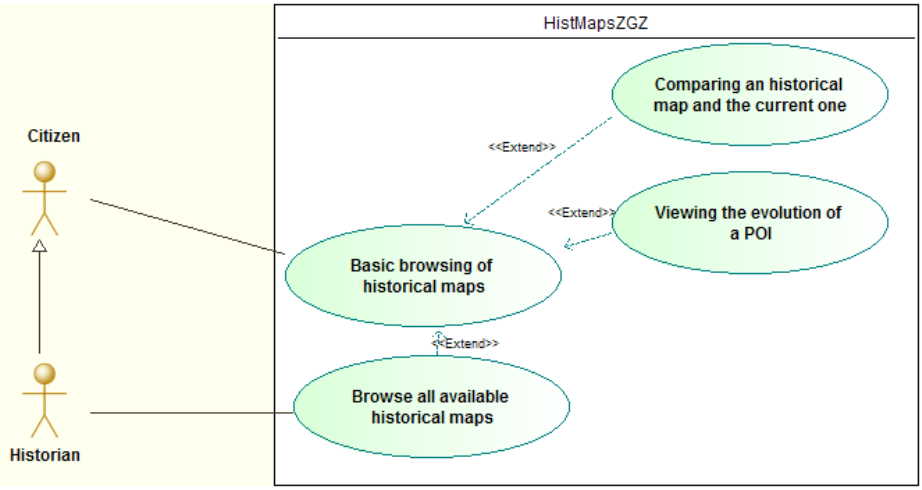


Figure 1: Use case diagram of HistMapsZGZ

3.1.2.3.3.1 Basic browsing of historical maps

Description:

The user is able to browse a set of preselected historical maps of the city of Zaragoza, both geographically and temporally. Geographically, the user is able to zoom in, out, move and set the map to the original display extent. Temporally, the user is able to change freely among the preselected historical maps, that are presented ordered chronologically to him or her, moving forward or backward in time.

Pre-conditions:

The user should access to the web page hosting the application with a web browser with JavaScript enabled.

Trigger:

The web browser has fully loaded the web page hosting the application.

Sequence of activities:

1. A predefined historical map of the city of Zaragoza appears, surrounded by icons allowing browsing the map both geographically and temporally.
2. The user interacts freely with the map by doing any of the following activities the number of time he or she desires, in the order he or she decides:
    - Zooming in the map around a point he or she signals.
    - Zooming in the map around the centre of the displayed map.
    - Zooming out the map around a point he or she signals.
    - Zooming out the map around the centre of the displayed map.
    - Moving the displayed area of the map in any direction, maintaining the zoom scale.
    - Setting the map to the original display extent.
    - Changing to other preselected historical map by choosing it from a time line
    - Printing the map.
    - Requesting information (help and legend) on the aforementioned tools.
    - Requesting information on the legend.
    - Executing the *Comparing an historical map and the current one* use case.
    - Executing the *Viewing the evolution of a POI* use case.
    - Executing the *Browse all available historical maps* use case.

Post-conditions:

The user has been able to browse a set of preselected historical maps of the city of Zaragoza,

both geographically and temporally.

Extensions:

Comparing an historical map and the current one, Viewing the evolution of a POI, Browse all available historical maps

3.1.2.3.3.2 Comparing an historical map and the current one

Description:

The user is able to compare a historical map with the current map of Zaragoza, having the current one as background and the historical in the foreground with a certain degree of transparency. User is still able to browse both maps geographically and temporally, by changing the displayed maps in the foreground or in the background to any of the historical and current maps available.

Pre-conditions:

The user is executing the *basic browsing of historical maps* use case

Trigger:

The user requests to compare the historical map in view with the current one

Sequence of activities:

1. The historical map in view is set to a degree of transparency and as foreground, appears the current map of Zaragoza.
2. The user interacts freely with the map by doing any of the activities stated in the *Basic browsing of historical maps* use case (that apply now to both the foreground and the background maps) the number of time he or she desires, in the order he or she decides, and the following one:
    - Setting as background map any of the following: IDEZar map, Google maps (satellite, map, or hybrid) or other available historical map

Post-conditions:

The user has been able to compare a historical map with the current map of Zaragoza.

3.1.2.3.3.3 Viewing the evolution of a POI

Description:

The user is able to view the historical evolution of a Point of Interest (POI) through the different historical maps available for that POI.

Pre-conditions:

The user is executing the *basic browsing of historical maps* use case.

Trigger:

The user selects a POI from a list of available POIs.

Sequence of activities:

1. The map is zoomed in or out to the POI, to a scale appropriate to visualise it, together with part of its surroundings.
2. The user interacts freely with the map by doing any of the activities stated in the *Basic browsing of historical maps* use case the number of time he or she desires, in the order he or she decides (mainly the change of displayed historical map by choosing it from a time line)

Post-conditions:

The user has been able to view the historical evolution of a Point of Interest (POI).

3.1.2.3.3.4 Browse all available historical maps

Description:

The user is able to get a list of all the historical maps of the city of Zaragoza included in IDEZar (not only the preselected ones).

Pre-conditions:

The user is executing the *basic browsing of historical maps* use case.

Trigger:

The user requests a full list of the historical map in IDEZar available for the geographical extent he or she is currently exploring

Sequence of activities:

1. A query to the IDEZar catalogue service is made (directly or via the VH).
2. A list of all the available historical maps stored in IDEZar is presented to the user, together with some of the available metadata (title of the map, author, year, preview miniature)
3. The user selects one of them, that become the active map and can be browsed freely by doing any of the activities stated in the *Basic browsing of historical maps* use case the number of time he or she desires, in the order he or she decides.
4. Alternatively, the user does not choose any of them, and he or she continues browsing the previous selected map, with no change in zooming scale, or extent.

Post-conditions:

The user has been able to get a list of the brose a set of historical maps of the city of Zaragoza included in IDEZar that match with the geographical extent that he or she is using in that moment, and, if he or she has wanted, has been able to browse it.

3.1.2.4 Operating Environment

3.1.2.4.1 Hardware

- **IDEZar**
  Owned and maintained by the Zaragoza Council. The infrastructure is supported by 6 servers (configured with load balancing policy)
- **VH-ES**
  Currently, it is owned and maintained by UNIZAR. VH-ES has already been deployed, consisting of three virtual machines running on a SUN FIRE x4150 server with the following characteristics:
  - QUAD CORE Xeon E5450 3GHz
  - 48GB RAM
  - 880 GB of hard drive (RAID)
  - VMware vSphere 4.0.0 software license included
- **Client**
  In order to run the application, users will need a regular computer, with no particular hardware restrictions.

3.1.2.4.2 Software

- The Spanish VH is running on VMware vSphere 4.0.0, license attached to the hardware in which is running.
- The Spanish VH is an instance of the GI-suite Brokering Framework

- In order to run the application, end users will need a web browser. The following browsers will be supported: Mozilla Firefox 4+, Google Chrome, Safari 6+, Internet Explorer 9+, Opera 11+. Support for HTML5 & CSS3 are needed in the browsers.
- JavaScript (with version depending on the web browser; development will support its latest version 1.8.5)
- jQuery 1.8 + JQueryUI
- OpenLayers 2.12

3.1.2.5 User Documentation

All the web applications the Council offers through its web portal are addressed to regular citizens. This implies that all applications (including HistMapsZGZ) have to be intuitive and easy to use. Help will be provided to the user mainly in the form of tooltips. On-line help and tutorials will be considered if during testing, difficulties of use appear. A user manual is not foreseen, at least outside the scope of ENERGIC OD.

3.1.2.6 Assumptions

- Collaboration of the Zaragoza Council staff is required especially to obtain the historical maps of the city from their archive. These historical maps will be used as source data of the application.
- Collaboration of the Zaragoza Council staff will be also required for the deployment, testing and dissemination phase.
- The VH is capable of implement the foreseen new required functionality (access to GeoTIFF files through HTTP to offer a WMTS).

3.1.2.7 Constraints

- The ENERGIC OD VHs must be part of the solution.
- Those derived from the integration of the application in the existing IDEZar infrastructure.

3.1.3 External Interface Requirements

3.1.3.1 User Interfaces

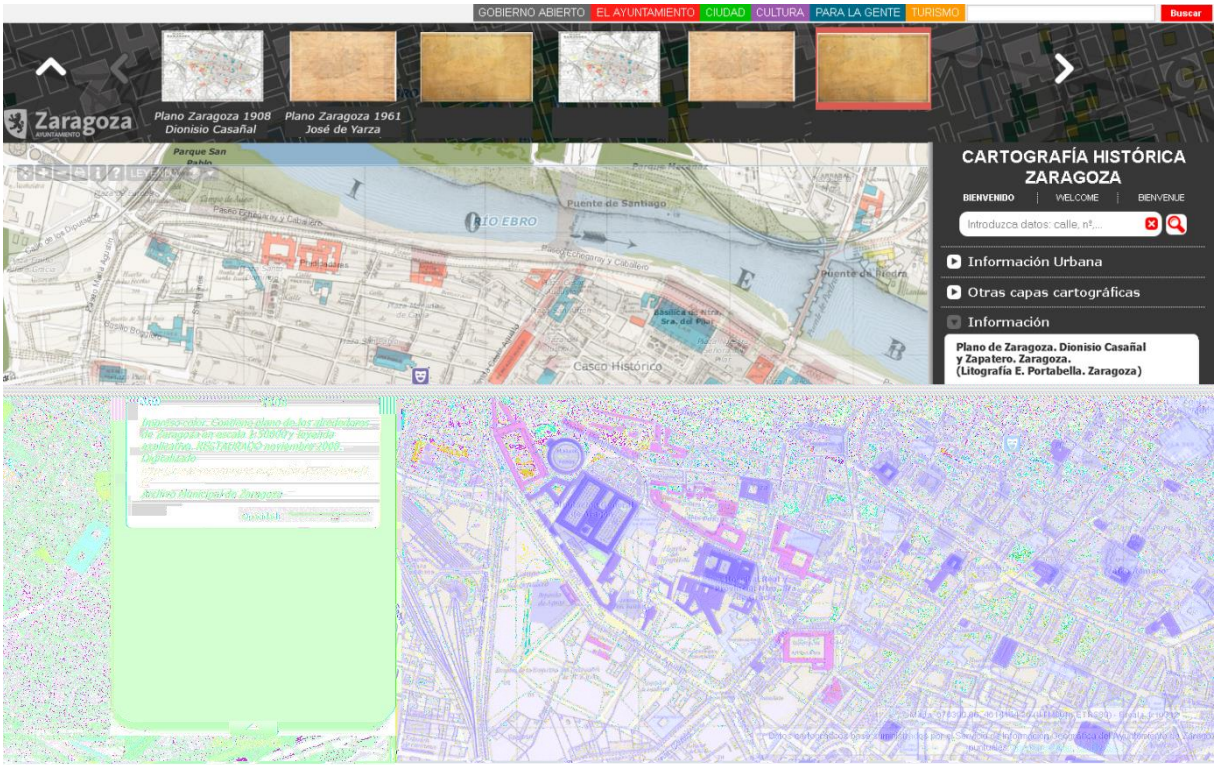


Figure 2: GUI prototype for the HistMapsZGZ application

3.1.3.2Hardware Interfaces

The solution will be executed on different hardware components:

- The six servers that compose IDEZar, but that act as only one system from the logical point of view
- The server where the VH-ES is hosted
- The user computer, where the application will run inside a web browser

All the interactions among the hardware nodes will be at software level and is described below in the following sections.

3.1.3.3 Software Interfaces

The only software interface not involving the VHs and other data sources involve the user browser interacting with the IDEZar geoportal web server to access and download the web page where the application is.

3.1.3.4 Virtual Hubs and Data Sources

Interactions between the user browser and the VH

- Requesting and receiving historical maps
- Requesting and receiving current maps
- Requesting and receiving metadata on historical maps

Interactions between the VH and IDEZar

- Requesting and receiving historical maps
- Requesting and receiving current maps
- Requesting and receiving metadata on historical maps

3.1.3.5 Communication Interfaces

Interaction between the user browser and IDEZar: HTTP

Interactions between the user browser and the VH

- Requesting and receiving historical maps: WMTS with tiles in PNG or JPEG format
- Requesting and receiving current maps: WMTS with tiles in PNG or JPEG format
- Requesting and receiving metadata on historical maps: CSW with metadata records in ISO 19139 compliant XML.

Interactions between the VH and IDEZar

- Requesting and receiving historical maps: HTTP with maps in GeoTIFF format
- Requesting and receiving (tiled) current maps: WMTS with tiles in PNG or JPEG format
- Requesting and receiving metadata on historical maps: CSW with metadata records in ISO 19139 compliant XML.

3.1.4 Functional Requirements

ID	F01A1
Requirement	User access to a preselected list of historical maps of the city of Zaragoza
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps
Description	The user has access to a catalogue of preselected list of historical maps of the city of Zaragoza. They are ordered chronologically.

ID	F02A1
Requirement	Query a specific historical map of the city of Zaragoza
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one
Description	The user has a tool to switch between the historical maps of the catalogue of preselected list of historical maps of the city of Zaragoza. He or she is able to overlay it over the current map of the city (IDEZar map)

ID	F03A1
Requirement	Discover the historical map navigating freely in the map
Priority	High

Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps
Description	The user has tools to navigate freely in the map: zooming, panning or moving to the original extent

ID	F04A1
Requirement	Print the historical map
Priority	Low
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps
Description	The user has a tool to print the current view of the map independently of the background map and the overlay map (historical map) present in that moment.

ID	F05A1
Requirement	Query the help tool
Priority	Low
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps
Description	The user has a tool to query a help menu that shows off a legend and useful information in order to help users.

ID	F06A1
Requirement	Compare the historical map with the current map of the city managing the transparency tool
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one
Description	The user has a tool for managing the transparency of the historical map. This tool is a usable and easy way (with a slider tool) to create a good environment in order to compare visually the current map of the city with the historical one.

ID	F07A1
Requirement	Change the background or base layer
Priority	Medium
Use Case Reference	3.1.2.3.3.2 Comparing an historical map and the current one
Description	The user has a tool that offers the capability to change freely the base layer. The base layers available are IDEZar and Google Maps (satellite, map or hybrid).

ID	F08A1
Requirement	Show several Points Of Interest (POI) over the map previously selected as the most interesting areas in the city to discover historical maps and their evolution
Priority	High
Use Case Reference	3.1.2.3.3.3 Viewing the evolution of a POI
Description	The user is able to identify over the map POIs that represent specific areas of the city known as interesting areas due to the historical maps with information about them.

ID	F09A1
Requirement	Select a specific Point Of Interest (POI) to discover its historical maps and their evolution
Priority	High
Use Case Reference	3.1.2.3.3.3 Viewing the evolution of a POI
Description	When the selection is made, the map moves automatically to the better area and scale to ensure a perfect visualization of the information. Also, the user is able to select the historical map between the available maps of the POI with a useful and usable tool in the form of a timeline that empowers the user capabilities to discover the POI's historical maps.

ID	F10A1
Requirement	Browse all available historical maps of the catalogue
Priority	Medium
Use Case Reference	3.1.2.3.3.4 Browse all available historical maps
Description	The user has the capability to query all historical maps of the city (not only the preselected ones) in order to discover and compare them freely. Is estimated that a query will be necessary to access the whole catalogue if its size is large enough.

3.1.5 Non-Functional Requirements

ID	N01A1
Requirement	Usability
Priority	High
Description	All the web applications the Council offers through its web portal are addressed to regular citizens. This implies that all applications (including HistMapsZGZ) have to be intuitive and easy to use.

ID	N02A1
Requirement	Usability. User help

Priority	Medium
Description	Help will be provided to the user mainly in the form of tooltips. On-line help and tutorials will be considered if during testing, difficulties of use appear.

ID	N03A1
Requirement	Accessibility
Priority	High
Description	All the web applications the Council offers through its web portal have to be accessible according to the Web Content Accessibility Guidelines (WCAG) 2.0 (W3C Recommendation 11 December 2008). This means that, to comply with the guidelines, alternative texts for the maps should be provided.

ID	N04A1
Requirement	Accuracy
Priority	Medium
Description	The solution provides visualization of data and results of data analysis of a high quality

ID	N05A1
Requirement	Maintenance
Priority	Medium
Description	The solution requires no or minimal redesign in case of new data, data sources, changed standards, interfaces or protocols.

ID	N06A1
Requirement	Scalability
Priority	High
Description	The solution will run as browser based application on many operating systems as possible.

ID	N07A1
Requirement	Usability
Priority	High
Description	The solution will run as browser based application on many operating systems as possible.

ID	N08A1
Requirement	Usability
Priority	Medium

Description	Outputs with information about warnings, errors, instructions and data sources for users have to be clear.

ID	N09A1
Requirement	Usability
Priority	Low
Description	The solutions have a multi-language support.

ID	N10A1
Requirement	Restriction
Priority	High
Description	Integration in municipal web of the Zaragoza city council. The application deployment has to be made on the Zaragoza city council infrastructure considering and respecting their technological environment

3.1.6 Data Requirements

ID	D01A1
Requirement	Accuracy
Priority	Medium
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one 3.1.2.3.3.3 Viewing the evolution of a POI 3.1.2.3.3.4 Browse all available historical maps
Description	Accuracy of the georeferenced historical maps should be enough for having smooth transitions when changing from one historical map to other and for allowing its comparison with the current map or among them.

ID	D02A1
Requirement	Resolution
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one 3.1.2.3.3.3 Viewing the evolution of a POI 3.1.2.3.3.4 Browse all available historical maps
Description	Resolution of the scanned maps should be high, in order to allow zooming in

ID	D03A1
Requirement	Content
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one 3.1.2.3.3.3 Viewing the evolution of a POI 3.1.2.3.3.4 Browse all available historical maps
Description	The content of the predefined and catalogued historical maps will be historical maps of the city of Zaragoza provided by the Zaragoza Council Archive as Open Data.

ID	D04A1
Requirement	Coverage
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one 3.1.2.3.3.3 Viewing the evolution of a POI 3.1.2.3.3.4 Browse all available historical maps
Description	The coverage of the predefined historical will be the city of Zaragoza. The coverage of the catalogued historical maps could be just part of the city.

ID	D05A1
Requirement	Format
Priority	High
Use Case Reference	3.1.2.3.3.1 Basic browsing of historical maps 3.1.2.3.3.2 Comparing an historical map and the current one 3.1.2.3.3.3 Viewing the evolution of a POI 3.1.2.3.3.4 Browse all available historical maps
Description	Current DjVu files containing the digitalised historical maps should be converted to a format that allows for georeferentiation.

ID	D06A1
Requirement	Metadata
Priority	High
Use Case Reference	3.1.2.3.3.4 Browse all available historical maps
Description	Historical maps should have appropriate metadata.

3.2 eye2eye (by AED-SICAD)

3.2.1 Introduction

eye2eye, the VH solution of AED-SICAD, will support communication among citizens and administration in the context of land consolidation. Citizens and affected landowners will be supported in participation in a formal land consolidation process. The involvement of other citizens (not only landowners) may arise in land consolidation processes for environmental or energy reasons (wind energy, solar energy …).

The goal is to shorten the long processing times and optimize citizens' participation. It is necessary to avoid legal proceedings against land consolidation plans. eye2eye should be a tool for brainstorming and discussion by georeferenced comments on the basis of map-based apps. This will complement traditional paper wise participation methods.

3.2.2 General Description

3.2.2.1 Product Perspective

The app eye2eye shall be integrated in the existing solution environment available at the "Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft des Landes Brandenburg" (Ministry of Rural Development, Environment and Agriculture of the Federal State of Brandenburg) and the "Verband für Landentwicklung und Flurneuordnung Brandenburg" (Association for Rural Development and Land Consolidation Brandenburg), see section 3.2.2.3 (User Characteristics).

The solution has a multilayer architecture. This layered architecture is shown in the following figure.

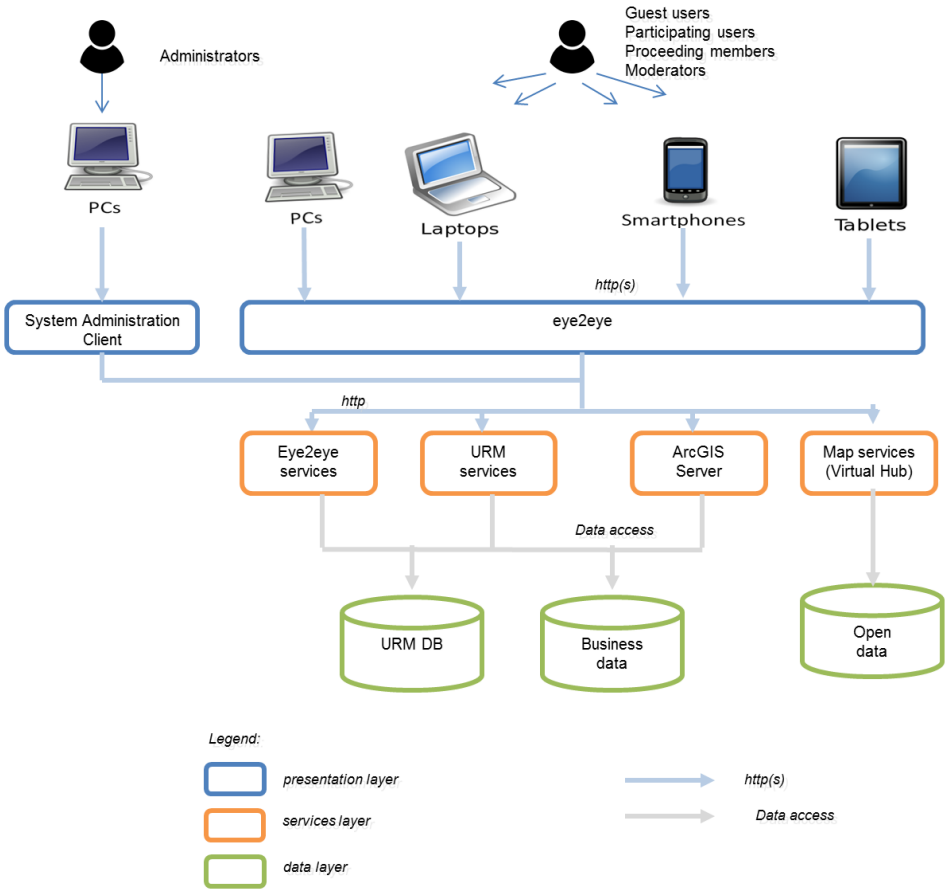


Figure 3: eye2eye multi layered architecture

The presentation layer contains the eye2eye web application with the HTML user interfaces, which are accessed from clients (smartphones, tablets, laptops, PCs) via http(s). It also contains a system administration client.

The services layer provides the necessary business-logic functions in the form of a service-oriented infrastructure (SOA) that can be addressed by the presentation layer through web-based REST interfaces:

- eye2eye services: Represents the actual business functions, that are used in the Web App
- URM-services: Provides functions for user management and rights management
- ArcGIS Server: Provides map services
- Map services (VH): eye2eye will use data sources from the VH which will be set up and provided by AED-SICAD as a cloud solution.

The communication between the components of the presentation layer and the service layer happens via http(s).

The data layer contains all data of the system (user data, configuration data, and business data).

The perspective of the solution states whether the solution will be part of an existing system of solutions or is a new solution. In context of ENERGIC OD the VHs must be stated.

3.2.2.2 Product Functions

eye2eye is foreseen as a mobile App for webmapping, information, digitizing of notes or drawings

- As a webmap app it enables to easy navigate in maps.
- Users can request information on objects from maps.
- Input of georeferenced text notes would be a major function for participation.
- Likes might help to easy comment details of plans.
- Digitizing drawings for change management is supposed to be an optional feature in sense of redlining or drawing on top of a map.

3.2.2.3 User Characteristics

3.2.2.3.1 User Classes

A land consolidation process has two phases. In the first phase, the so-called preliminary procedure, there is a wide citizen's participation in order to reach acceptance and to detect who might be affected by a planning process. The follow up process is a closed and strictly regulated management in a community of affected land parcel owners. eye2eye will focus on the first phase for public citizens' information.

The users of the app can be classified into different user groups with different rights:

- Open citizens participation user groups (major focus of eye2eye):
  - **Guest users**: Access is without registration. This user group has access to general and freely accessible information about land consolidation procedures.
  - **Participating users**: Users can register themselves and thus becomes participating users. As a member of this user group a user has the opportunity to create and access (geospatial) comments.
- User group of proceedings member (not primary in focus of eye2eye):
  - **Proceedings member**: He has access to the same functions as participating users. In addition, he has access to non-public information about the land consolidation proceedings in which he is involved.
- User groups of administrative users (major focus of eye2eye)
  - **Moderators**: Moderators have the ability to read, answer and delete (if necessary) user comments.
  - **Administrators**: Administrators take over the technical maintenance of the application. The configurations and parameters can be set in a browser on the desktop. An administrator has full access to all functions and services of the app and their configuration. For this purpose, administration tools are provided to him, but these tools do not have to be geared to mobile use.

3.2.2.3.2 Relation of Users and System Components

Depending on the user group to which he belongs, every user has different rights as described in the section above. He also has access to different system components.

- Open citizens participation user groups (major focus of eye2eye):
  - **Guest users**: Direct http(s)-access to eye2eye presentation layer without eye2eye system administration client. Via presentation layer indirectly access to service layer components. Only a small subset of functions is available (displaying of public mapping and textual information).

- **Participating users**: Direct http(s)-access to eye2eye presentation layer without eye2eye system administration client. Via presentation layer indirectly access to service layer components. Mapping, navigation and commenting features available. Has only access to public information.

- User group of proceedings member (not primary in focus of eye2eye):
  - **Proceedings member**: Direct http(s)-access to eye2eye presentation layer without eye2eye system administration client. Via presentation layer indirectly access to service layer components. Mapping, navigation and commenting features available. Has access to public and non-public information.
- User groups of administrative users (major focus of eye2eye)
  - **Moderators**: Direct http(s)-access to eye2eye presentation layer without eye2eye system administration client. Via presentation layer indirectly access to service layer components. Full access to all system functionalities without system administration functionalities.
  - **Administrators**: Direct http(s)-access to eye2eye presentation layer with eye2eye system administration client. Full access to all system functionalities.

3.2.2.3.3 Use Cases

3.2.2.3.3.1 UC1: Guest User accesses information on land consolidation

Diagram:

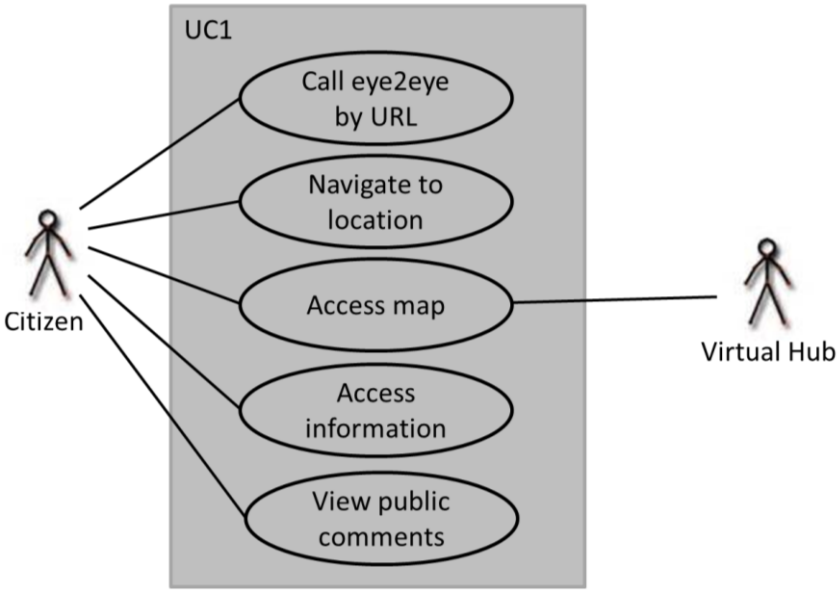


Figure 4: Use case diagram 1 – eye2eye

Description:

A citizen wants to get information about a land consolidation. He selects a web link and a browser to access information. He navigates to an information of interest by a list of land consolidation plans, an area in a map or an address or his location. He uses a map, text description and access to public comments for information.

Pre-conditions:

Public information on a planned land consolidation.

Trigger:

Read about a planned land consolidation and link to eye2eye webapp.

Sequence of activities:

Administration has to set up and publish information on planned land consolidation.

Post-conditions:

No post-conditions.

Extensions:

UC2

3.2.2.3.3.1 UC2: Participating User adds comments

Diagram:

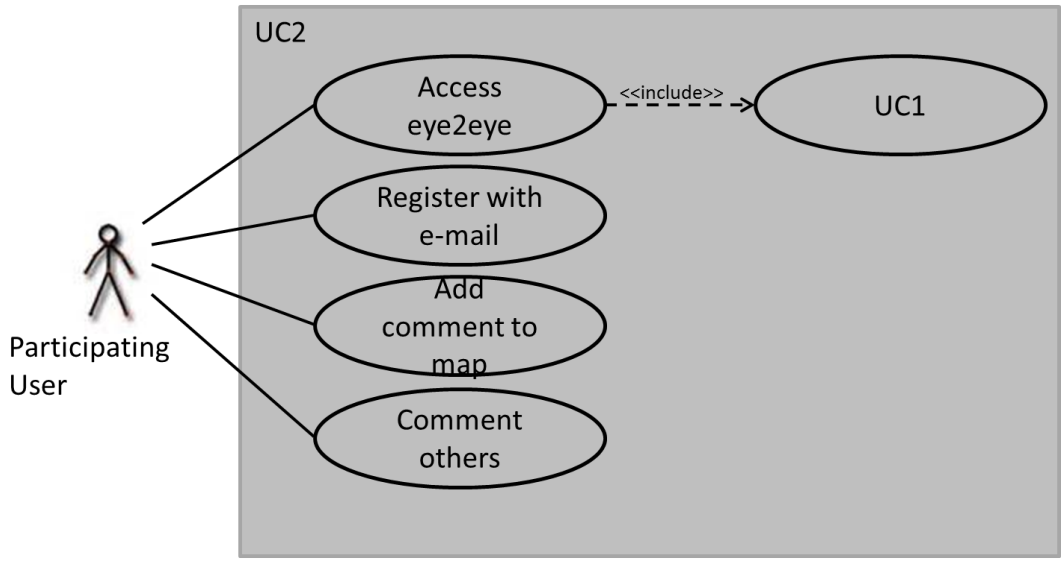


Figure 5: Use case diagram 2 – eye2eye

Description:

A citizen wants to participate in a discussion on land consolidation plans. He adds comments onto a map or as a reply to other comments.

Pre-conditions:

Public information on a planned land consolidation. User must have a public email account.

Trigger:

Citizen wants to add his own comments on a land consolidation plan.

Sequence of activities:

The public user registers with a pseudonym and email address.

Post-conditions:

Participation user has an account for the board of comments.

Extensions:

None

3.2.2.3.3.1 UC3: Proceeding Member (not foreseen in eye2eye)

Diagram:

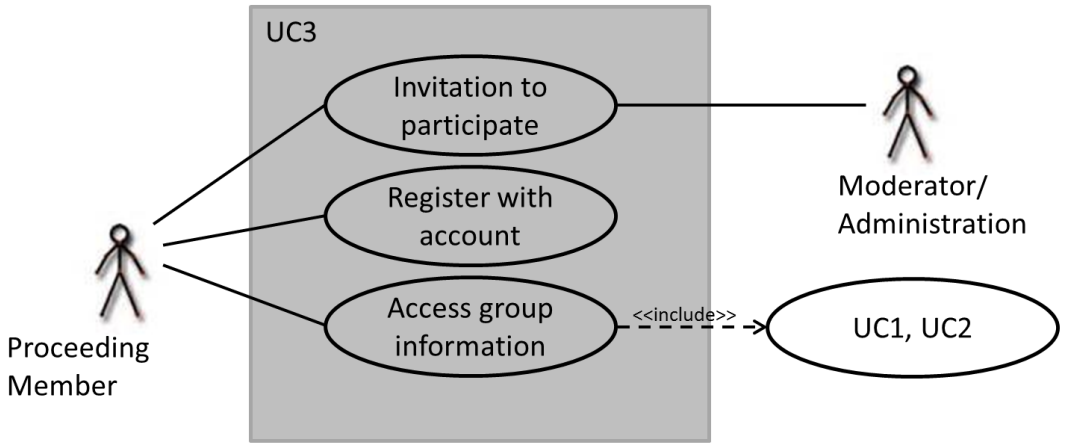


Figure 6: Use case diagram 3 – eye2eye

Description:

A citizen may become a member of a formal land consolidation participant group. The administration defines members of this group; Members are for example land parcel owners. Members are invited to the land consolidation participant group.

Pre-conditions:

Invitation to a formal land consolidation participant group.

Trigger:

Invitation includes a formal named user account for a land consolidation participant group.

Sequence of activities:

Register a proceeding member in a user and resource service. Get specific information access for members.

Post-conditions:

Proceeding member gets extended information for formal participant group.

Extensions:

UC1, UC2

3.2.*2.3.3.1 UC4: Moderating comments*

Diagram:

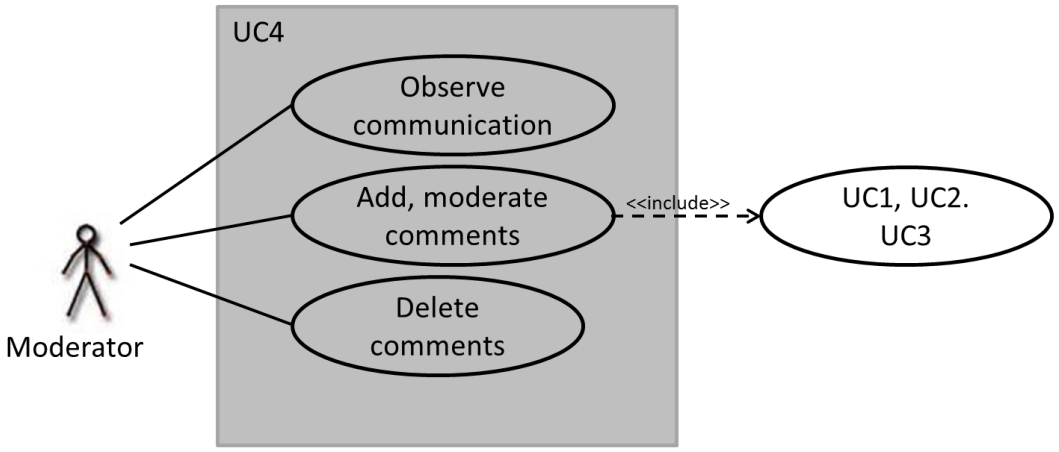


Figure 7: Use case diagram 4 – eye2eye

Description:

A moderator in an administration can access all information in a land consolidation process. He is manager of that process. He can comment, or if necessary delete comments.

Pre-conditions:

Member of a land consolidation administration registered in his role in eye2eye.

Trigger:

Moderator wants to comment or regulate improper comments of users.

Sequence of activities:

Register in eye2eye as a moderator. After login access all information on comments. Delete improper comments and add a note and reason.

Post-conditions:

Comments are marked as moderated or deleted.

Extensions:

UC1, UC2, UC3

3.2.2.4 Operating Environment

3.2.2.4.1 Hardware

The solution architecture, which has been described in chapter 3.2.2.1 leads to the following hardware architecture:

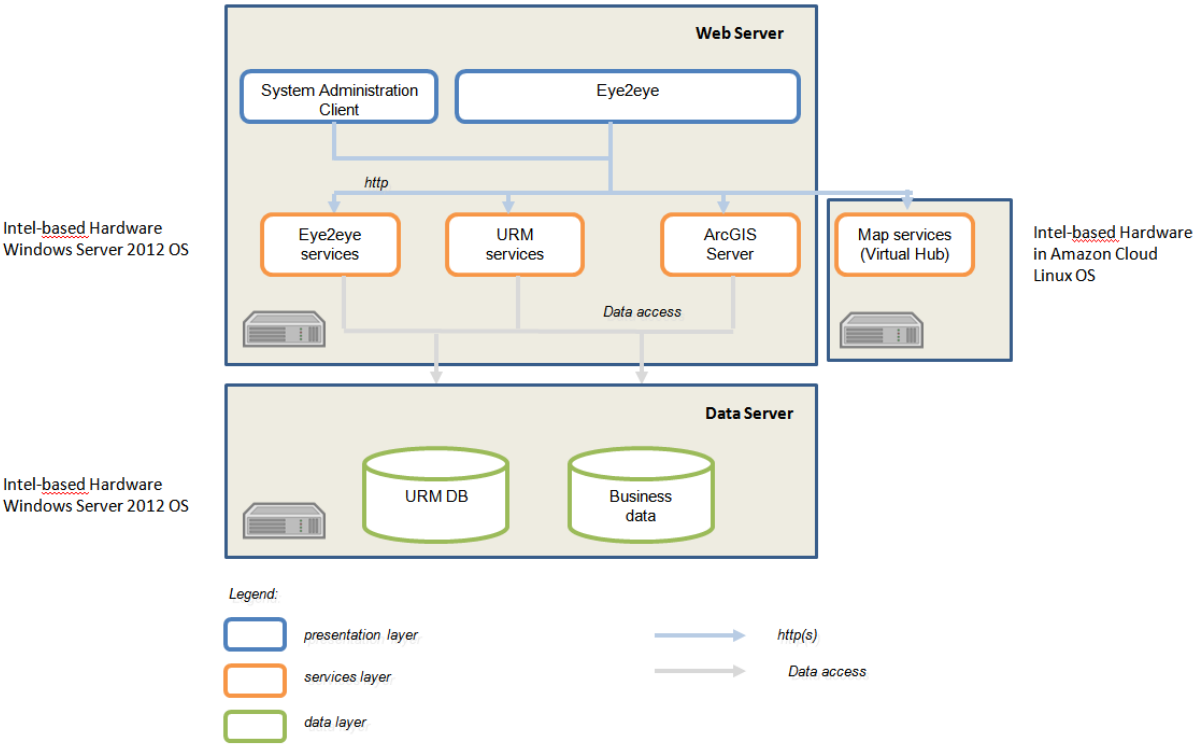


Figure 8: Hardware architecture – eye2eye

3.2.2.4.2 Software

The software used for the development of eye2eye solution consists of open source components under free licenses (such as Apache 2 license) except for some Esri components.

3.2.2.5 User Documentation

In the development of the solution eye2eye the implementation guidelines of the project ENERGIC OD will be used (see deliverable D6.2). Furthermore, the app will be developed in compliance with the standards defined by the quality management system of AED-SICAD, which is based on ISO 9001:2008.

User documentation will be integrated as follows:

- Tooltips for all users
- HTML Documentation for guest users and participating user or proceeding members
- Printed documentation and HTML documentation for moderators and administrators

3.2.2.6 Assumptions

eye2eye development will be based on the following assumptions:

- Availability of specialized land consolidation services
- eye2eye will assume GSM broadband connections in the country side for online access
- The app will be designed for best use on Tablets or Phablets
- Open Data shall be available for environment, traffic, landscape, ecology
- INSPIRE services shall be accessible almost for ANNEX I, II, maybe III
- eye2eye should bring added value of mobile support to the desktop solutions
    - Mobile App shall base on the same service infrastructure

3.2.2.7 Constraints

General

The following constraints can impact the development or the design of the new eye2eye app:

eye2eye will integrate several services and new technologies; this will be done in regard of limited budget and time resources

Core technologies shall be available as software libraries of the shelf and for the users GIS solution

Identify and specify supported processes with user group exactly enough

Specify datasets to be used and the at least partly controlled access

Licences

The technology used is based Open Source as far as possible. A small area of software development is based on ESRI technology, which is license protected accordingly:

- Software
  - Licence protected:
    - ArcGIS Server
    - Portal for ArcGIS
  - Open Source
    - Eclipse
    - Java
    - JavaScript-Frameworks (e.g. dojo, ArcGIS JavaScript API)
- Data
  - License protected
    - Data of land consolidation proceedings
  - Open Data
    - Data within VH

Human Resources

As a software and solutions provider, AED-SICAD employs qualified software developers and project managers, who have successfully carried out large-scale development projects in the Public Sector and Utilities in recent years. The required skills for realizing the solution eye2eye are available at the project staff of the AED-SICAD AG.

User Knowledge

No special knowledge is required to use the app eye2eye on the part of the end user.

Privacy & Security

The personal data that are used in the solution eye2eye are protected by a specified user concept so that they are accessible for authorized persons only for viewing and usage. This is ensured by technical safeguards that are implemented in work package “User resource management”.

All data transfers between the end-user device and the eye2eye system are carried out with a SSL encryption. This ensures that intercepted communication cannot be evaluated.

The implementation of the solution eye2eye is based on today's state-of- the-art techniques,

which take into account the usual attack procedures on web-based applications and eliminate them.

3.2.3 External Interface Requirements

3.2.3.1 User Interfaces

The app will contain the following main user interfaces which are based on HTML:

Access general information about land consolidation

Using this user interface the user gets access to general and freely accessible information about land consolidation processes. It is freely accessible to all user groups and does not require authentication. The information can be accessed via the following steps:

1. Selection of the search options:
   The user can select one of from several search options, for example
   - Search by process name
   - Search by reference number
   - Search by status
   - Search by date or time intervals
2. Specifying the appropriate search criteria:
   In the next, the search criteria are entered and thus the search started.
3. Display of search results:
   After the search is performed, the land consolidation processes found are displayed in a result list. By selecting result entry, the corresponding geometry will be highlighted in the map.
4. Display the project data to a selected land consolidation process:
   Each entry in the search results list contains a link "project data". When clicking on this link the publicly available information of the corresponding land consolidation process is displayed.

Creation and Accessing of Comments

This user interface gives the user the ability to create comments and view already existing comments. To use this interface an authentication is needed. It can be accessed by the following user groups:

- Participating users
- Proceeding members
- Moderators
- Administrators

The user interface provides the user with the following functions:

- Creation of own comments
  With this function the user has the ability to create own comments. For a comment several properties can be entered, for example:
  - Title
  - Spatial geometry
  - Text

- Pictures, videos, documents, …
- Target audience (public, administration)
- Status

- Access to existing comments

With this function the user has the ability to access existing comments. The functional range depends on the user group of the user.

- Participating users and Proceeding members:
  These users have access to their own and public comments. Users can read the comments and add further own comments
- Moderatos and Administrators:
  These users can access all existing comments. Users can review comments, answer comments and delete comments if necessary.

3.2.3.2 Hardware Interfaces

The used hardware architecture is shown in ***Figure 8***.

Basically there are two servers:

- The Web Server contains the web application and the web services of the solution. The web application and the web services are design to be scalable. When needed, multiple web servers can be built and addressed via a load balancer.
- The data server contains the used database with the needed data. If needed, database specific load balancing features can be used to distribute data on multiple servers and thus respond to high usage.

The needed hardware interfaces are provided by the used operation system and thus descripted in the corresponding documentation of the OS.

3.2.3.3 Software Interfaces

The solution uses the following software interfaces:

- ArcGIS for Server and Portal for ArcGIS interfaces (REST, SOAP)
- DB-interfaces (e.g. JDBC)
- Interfaces of the used Java and JavaScript libraries
- Interfaces of VH

3.2.3.4 Virtual Hubs and Data Sources

The solution will use data sources from the VH which will be set up and provided by AED-SICAD. The data sources which will be used are described in deliverable D6.3.

3.2.3.5 Communication Interfaces

The app uses the following communication interfaces:

- Between user and Solution: HTML-based GUI of the Web App in browser, the HTML is loaded via https (optional http can be used)
- Between Web App and Web Services: https, optional http can be used
- Between Web App and data: corresponding data access protocols (e.g.JDBC)

3.2.4 Functional Requirements

ID	F01A2
Requirement	Visualisation
Priority	High
Use Case Reference	All
Description	Display general, publicly available information on land consolidation processes

ID	F02A2
Requirement	Visualisation
Priority	Low
Use Case Reference	All
Description	Integration of additional spatial information as required (Copernicus, INSPIRE and Open Data)

ID	F03A2
Requirement	Navigation
Priority	High
Use Case Reference	All
Description	Navigation functions to navigate on the displayed map and indicate objects

ID	F04A2
Requirement	Exchange of data
Priority	High
Use Case Reference	UC2, UC3, UC4
Description	Spatial comment and discussion functions

ID	F05A2
Requirement	Exchange of data
Priority	High
Use Case Reference	UC4
Description	Functions for moderation (e.g. Review / answering / deletion of comments)

ID	F06A2
Requirement	Visualisation and user access
Priority	Low
Use Case Reference	UC3
Description	Participation in proceedings of the land consolidation process by providing information to authorized persons

ID	F07A2
Requirement	User access
Priority	High
Use Case Reference	All
Description	Classification of users into different user groups with different rights

ID	F08A2
Requirement	Administration and user access
Priority	High
Use Case Reference	UC4
Description	Administrative functions to configure the services and functions of the app.

3.2.5 Non-Functional Requirements

ID	N01A2
Requirement	Usability
Priority	High
Description	eye2eye app shall be easy to use.

ID	N02A2
Requirement	Usability
Priority	High
Description	Design is oriented on users without expertise in mapping apps.

ID	N03A2
Requirement	Security
Priority	High
Description	User will be registered in order to get access and insert personalized statements in the official process.

ID	N04A2
Requirement	Security and accessibility
Priority	High
Description	Free access to free datasets shall be given to citizens in general.

ID	N05A2
Requirement	Usability and portability
Priority	High
Description	Portability and usability in the field at locations of planning is necessary.

ID	N06A2
Requirement	Portability
Priority	Medium
Description	eye2eye app will be as flexible as possible to different devices and operating systems but must focus to certain resolutions of screens.

3.2.6 Data Requirements

ID	D01A2
Requirement	Public information maps and description
Priority	High
Use Case Reference	UC1, UC2
Description	Webmap informs on land consolidation plans. Linked text describes land consolidation plan. Additional WMS Layer from VH integrated.

ID	D02A2
Requirement	Comments in a map
Priority	High
Use Case Reference	UC1, UC2, UC3, UC4
Description	Add georeferenced comments to a map. Present comments in a map. Medium: Probably clustering of comments in overviews.

3.3 Coastline Evolution Monitoring (by BRGM)

3.3.1 Introduction

The software application for BRGM is a mobile application broadcasting the coastline, and allowing crowed sourcing.

The need of this application comes from different sources:

- Some of the coastline data in France are not yet published
- The potential of crowdsourcing is giving a new challenge for science. The idea of this

application is to use crowdsourcing in order to create/enhance public knowledge.

This mobile application is going to be a proof of concept for scientific open data publication and crowed enhancement.

3.3.2 General Description

3.3.2.1 Product Perspective

The challenge faced by the mobile coastline application, is to open data to the public, and also to enhance the scientific knowledge with a well-structured crowdsourcing input from users.

3.3.2.2 Product Functions

The Coastline application shall display a background map on which the user can browse. A different background layer can be chosen. Default background is French SCAN25, and it may be changed for Orthophoto background.

The software shall allow browsing, access selected coastline. The coastline data are sets of data organized as coastlines. Basically they are defined by an organization, and the date of acquisition.

The user shall choose the coastline(s) he wants to see.

Once authentified, he may create observations. One can see its own observations. An observation is basically the crowdsourcing. It can be of different types detailed in section 3.3.2.3.

The user may also fill/edit/access its own data.

This data should open metadata giving the fields to fill in, including a picture of the site.

This ‘crowdsource’ shall be accessible (read-only) for other users.

This innovative mix between open data and crowdsourcing shall be an example for the consortium members to propose local authorities enhance services.

3.3.2.3 User Characteristics

On the mobile application, an **unregistered user** may browse the open data coastline and see the approved crowdsourcing dataset.

A registered user may do the same, and add/see its own observations.

An Expert shall access the same features, and also approve crowdsourcing observations. These approved observations become open data from the application point of view.

3.3.2.3.1 User Classes

3.3.2.3.2 Relation of Users and System Components

The mobile application shall use LDAP Web Services to ask for a user account, or to retrieve the rights of a given users.

Each called method will be sorted with a user profile.

3.3.2.3.3 Use Cases

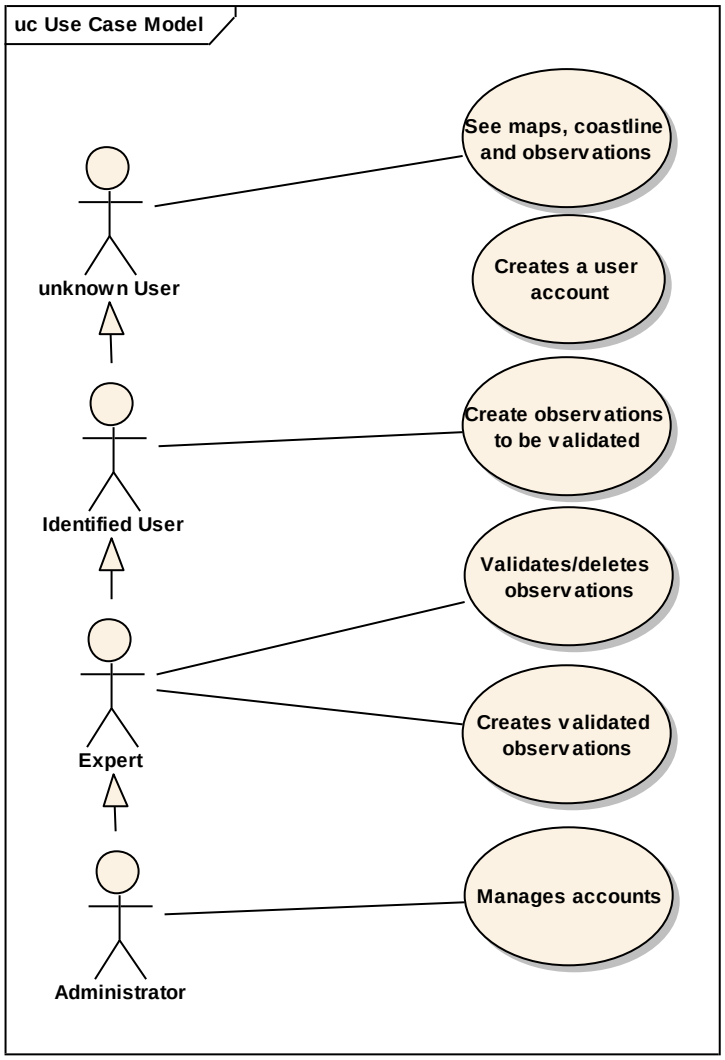


Figure 9: use case of coastline mobile application

- An unknown user can download “Coastline” application. He is allowed to browse the map (IGN scan 25, or Orthophoto) and may select the coastline(s) he wants to display. He can also select the observations. He may ask for a standard user account creation.
- An Identified user has the rights as an unknown used, and may create observations.
- An expert has the same rights as an Identified user, can also validate the observation or create its own validated observations. He has the right to delete observations.
- The Administrator has all the rights on the application, including the management of accounts such as creating Expert and Administrator accounts.

3.3.2.3.3.1 See maps, coastline and observations

A non-registered user is allowed to browse the background map, and to select coastline data and observations.

Figure 10: application overview 1 - coastline mobile application

Getting the GPS coordinates, the application will zoom by default on:

- the French “department” if the user is 2km near a coast
- the French “Region” if the user is less than 50km near the coast
- the whole metropolitan country otherwise.

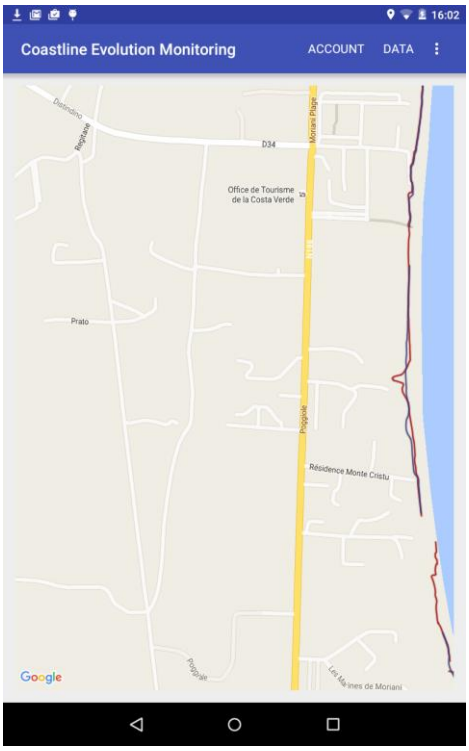


Figure 11: application overview 2 - coastline mobile application

The user shall be able to choose a time window in order to display on its application the coastline at a given time if available.

3.3.2.3.3.2 Creates a user account

A user may want to report observations. For this action he is required to register.

Figure 12: Registration - coastline mobile application

In case the user is not registered he may create an account giving at least the mandatory fields: last name, surname and Email ID.
A captcha shall be inserted to prevent machines registration.

3.3.2.3.3.3 Create observations to be validated

Once registered a user may create and view its own observations.
There are 2 categories of observations:

- Report an event (high water, dune movement…). This report shall include a picture, a subcategory and comments.
- Draw a coastline section using GPS, a subcategory (such as dune low, feet in the water)

For any observation, the GPS position shall be send along with the date and time (of acquisition

for a punctual acquisition, of time of the start and end of acquisition for a coastline).

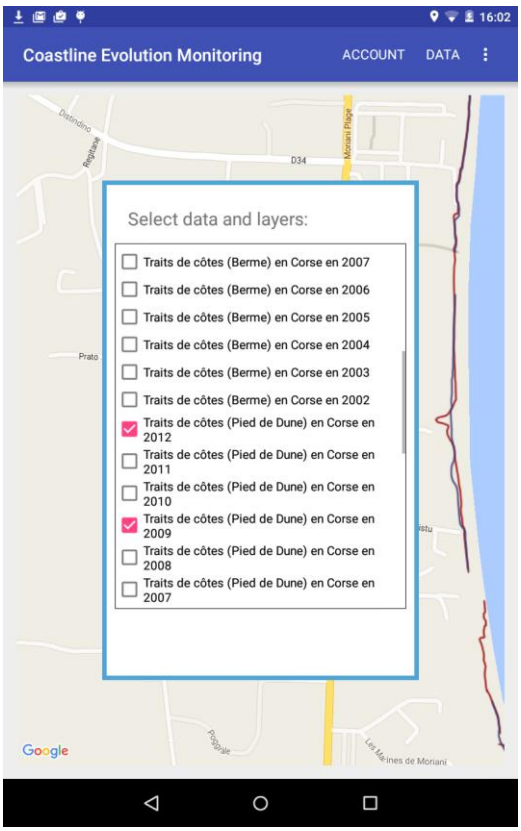


Figure 13: registered user data menu - coastline mobile application

3.3.2.3.3.4 Validates/deletes observations

An expert user can validate the observation as credible. This results in making this observation visible for all users, not only the observer and the Experts.

3.3.2.3.3.5 Creates validated observations

An observation made by an Expert user is immediately ‘validated’. It does not need any review.

3.3.2.3.3.6 Manages accounts

The administrator can create accounts of all types.

The application will use the LDAP services implemented at BRGM (https://forge.brgm.fr/projects/0-ws-authent)
On this LDAP, an ‘Application’ has been created called ‘EnergicOD’.
Several roles (profiles) have been created:

- User
- Expert

- Administrator

3.3.2.4 Operating Environment

3.3.2.4.1 Hardware

The mobile application shall be implemented for Android and shall not be hardware dependent.

3.3.2.4.2 Software

The mobile application will be designed for Android. The SOS/SWE part shall be using sensia software sources.

3.3.2.5 User Documentation

3.3.2.6 Assumptions

The technologies proposed for this application are not new, but their integration is innovative.

Of course we assume the application server and the VH are available at any time and also the data remains available at all time.

3.3.2.7 Constraints

The challenge of making public data available is not easy. Some of the existing coastline data are acquire with the help of public or private institution from which we need to get acceptance to make them open data.

3.3.3 External Interface Requirements

3.3.3.1 User Interfaces

3.3.3.2 Hardware Interfaces

The mobile application will be downloaded on the mobile phone.

3.3.3.3 Software Interfaces

3.3.3.4 Virtual Hubs and Data Sources

The mobile application will interact with a VH that will retrieve data from data services.

The aim of the application is to use the coastline open data (WFS INSPIRE) brokered by the VH to retrieve GeoJSON data.

Nevertheless, as the WFS to GeoJSON brick is not yet build, the application will use the WMS to start with.

Coastline data

The URL of the WFS is:

http://geoserver.brgm-rec.fr/geoserver/ows?

To request shoreline one can use:

http://geoserver.brgm-rec.fr/geoserver/ows?service=wfs&version=2.0.0&request=GetFeature&typeName=sr:Shoreline&COUNT=2

To request shore segment one can use:

http://geoserver.brgm-rec.fr/geoserver/ows?service=wfs&version=2.0.0&request=GetFeature&typeName=energicod:ShoreSegmentDetails&COUNT=110

The service distributes the data set. They can be differentiated according to these fields:

<energicod:beginLifespanVersion> Date of beginning of validity

<energicod:endLifespanVersion> Date of end of validity

<base2:organisationName> organization name

If required (to start developing the application) the WMS deployed on MapServer is the following:

URL:

http://mapsrefrec.brgm.fr/wxs/energic_od/tdcote?&SERVICE=WMS&VERSION=1.3.0&REQUEST=GetCapabilities

Here, each layer is already differentiated on fields: agency and date.

SOS and crowdsourcing

The option chosen by BRGM for crowdsourcing is a SOS technology. The mobile application will be seen as a captor.

The implementation chosen is Sensiasoftware.

The generic document is accessible at :

http://docs.opensensorhub.org

The source code for the existing Android application using sensia SOS is at:

https://github.com/opensensorhub/osh-android

To compile the app you must also download the source of OSH :

https://github.com/opensensorhub/osh-core

In the application, you can comment the part that relates to the sensor TruPulse (lines 145-165 of MainActivity.xml file). This will save you even download other two repositories.

3.3.3.5Communication Interfaces

3.3.4 Functional Requirements

ID	F01A3
Requirement	See maps, coastline and observations
Description	Browse the background map, and to select coastline data and observations

ID	F02A3
Requirement	Creates a user account
Description	In case the user is not registered he may create an account

ID	F03A3
Requirement	Create observations to be validated
Description	Create and view observations

ID	F04A3
Requirement	Validates/deletes observations
Description	Validate the observation as credible

ID	F05A3
Requirement	Creates validated observations
Description	An observation made by an Expert user is immediately ‘validated’.

ID	F06A3
Requirement	Manages accounts
Description	The administrator can create accounts of all types.

3.3.5 Non-Functional Requirements

ID	N01A3
Requirement	Reliability
Description	The reliability of the application should be above the average, by proper testing.

ID	N02A3
Requirement	Portability
Description	The portability shall be guaranteed by the limited operating system and machines used.

ID	N03A3
Requirement	Security
Description	The warning about the source and quality of information (open data versus crowdsourcing shall be clearly given to the users)

ID	N04A3
Requirement	Efficiency
Description	The services used to get background map and the coastline shall be accessible enough for a user to browse smoothly. The Capacity of 100 users at a time shall be tested. The degradation of service should be limited by a message before closing the application of users if more than 100 at a time. The time constraints must allow map tiles to be downloaded within seconds on a 4G terminal.

ID	N05A3
Requirement	Usability
Description	A Usability survey shall be done on beta-testers

ID	N06A3
Requirement	Dependability
Description	The dependability is inherent to the designed chosen (platform, operating system)

3.3.6 Data Requirements

ID	D01A3
Requirement	Coastline Open data
Description	The coastline data shall be harvested, and dropped on servers at BRGM. Web services (WFS, WMS) will then be designed to make them available. A Hub features will allow the transformation between services and data.

ID	D02A3
Requirement	Crowdsourcing data
Description	The application shall get the metadata to fill in for crowdsourcing. An API shall be designed for that purpose. It will access a dedicated catalogue in order to retrieve were to send the given data and picture.

3.4 OnoMap! (by CNRS-IRSTV)

3.4.1 Introduction

The OnoM@p (Open noise Map) system stands for a noise data architecture based on geo-localized sound levels measurements ensured by voluntary individual via a dedicated smartphone application named NoiseCapture. This application enables the user on one hand to estimate its noise exposure and on the other to upload its personal measurements to a server side database.

3.4.2 General Description

3.4.2.1 Product Perspective

NoiseCapture is a new application that will be used by the OnoM@p system. The NoiseCapture application will appear in the Google Play Store (*https://play.google.com/*) and optionnaly in F-Droid (*https://f-droid.org/*). It will be also included in the application catalogue of the GeoPAL platform (*http://www.geopal.org*).

3.4.2.2 Product Functions

NoiseCapture is an Android application to collect noise measures at a given location. The data are collected by smartphone, stored into a database via a web processing service and then published. An online processing is done in order to aggregate all provided data from users and virtual hub in order to propose human readable indicators that are published as interactive maps using WMS services. These OGC services are aggregated and exposed by the VH.

3.4.2.3User Characteristics

3.4.2.3.1 User Classes

The OnoM@p system is a single integrated platform which covers all workflow and lifecycle stages to collect, compute, share and display noise data and at the end inform the user about its noise exposure. In the OnoM@p ecosystem, we consider at least four levels of people who will play a role (Figure 14).

3.4.2.3.2 Relation of Users and System Components

The volunteer install and use NoiseCapture components, however it has to direct relation with GeoServices components as the mobile software acts as a frontend. The volunteer can have a map feedback of results after the transfer of measure.

The decision maker has access to web map frontend showing aggregated and analysed results of noise indicators.

The expert has control over GeoServices in order to add or update spatial and acoustics indicators analysis done there.

The system administrator manages the whole components in order to ensure the proper operational status of services.

3.4.2.3.3 Use Cases

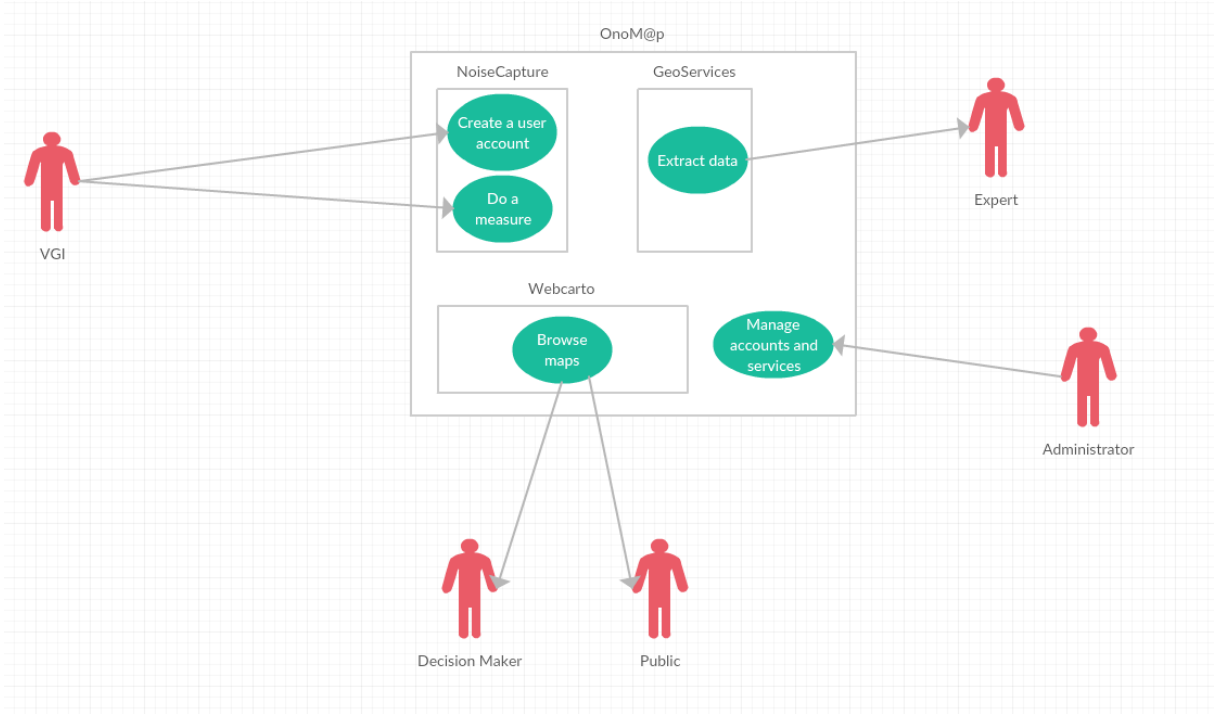


Figure 14: OnoM@p use cases

The VGI

The volunteer collects noise data from its smartphone and publish it on the OnoM@p database.

The Decision Maker

The Decision Maker is a stakeholder which can be in a public authority or in a company. He is using the visualization services (web map viewer) to see and understand the noise map exposure on its territory.

The Public

The Public is made of citizens or civil society organisations. They mainly use the visualization services to be aware of noise issues.

The Expert

An expert is someone (geographer, acoustician, …) who is able to understand and manage the raw data, extracted from the database, and to use it in its application domain to produce added value data (e.g. identify places where the noise exposure is too high, or analyse the evolution of the noise exposure on several years...).

The Administrator

The Administrator has all the rights on the application, including the management of accounts and Services (delete, rename WMS layers, update map styling...).

3.4.2.3.3.1 Create user account

Description:

A VGI creates a user account to activate the application.

Pre-conditions:

A username must be set.

Trigger:

Check if the username exists.

Sequence of activities:

1. The smartphone sends the username to the server
2. The server returns true is the username is ready to be used (or not already used).

Post-conditions:

The username must be validated to run the application.

Extensions:

-

3.4.2.3.3.2 Do a measure

Description:

A VGI starts and stops a measure.

Pre-conditions:

Sensors must be activated.

Trigger:

Check if the sensors are available.

Sequence of activities:

-

Post-conditions:

Run the signal processing algorithm to compute noise indicators. When the VGI stops the measure, the data is send to the server.

Extensions:

-

3.4.2.3.3.3 Extract data

Description:

An expert can extract noise data collected from the smartphone using a Web Processing Service client. The data are extracted from the CNRS database (see D4.2).

Pre-conditions:

-

Trigger:

A WPS request is send to the Geoservices by a client. The client must be connected to the WPS repository using an URL.

Sequence of activities:

1. Connect to the WPS repository
2. Select the WPS extract command
3. Save the data

Post-conditions:

-

Extensions:

-

3.4.2.3.3.4 Browse maps

Description:

A Decision Maker or a citizen can navigate on the noise map using a web browser.

Pre-conditions:

The user should access to the web page hosting the application with a web browser that enable JavaScript.

Trigger:

The web browser has fully loaded the web page hosting the application.

Sequence of activities:

-

Post-conditions:

-

Extensions:

-

3.4.2.3.3.5 Manage accounts and services

Description:

The administrator can create accounts of all types.

Pre-conditions:

The administrator account must be connected with all application services hosted by OnoM@p.

Trigger:

-

Sequence of activities:

-

Post-conditions:

-

Extensions:

-

3.4.2.4 Operating Environment

3.4.2.4.1 Hardware

Server services require a dedicated computer running with high availability. Software development of the mobile application require a desktop computer with a smartphone for testing the application.

Production server:

Processor: Intel Xenon X3480, 3,06 GHz
RAM: 16 GB
Disk Space: 1 TB SATA
Operating System: Ubuntu server, 64 Bit

3.4.2.4.2 Software

Implementation software, tools

Android Studio – v1.5.1 Android Software Development Kit License. Used to make android client application using native API.

IntelliJ IDEA - Java IDE used for server side developments.

Software, libraries and frameworks

MPAndroidChart v2.0.8 – Apache License, Version 2.0. Rendering of noise indicator graphics on the android client

H2GIS v1.2X – Spatial enabled database

GeoServer v2.8X – Provide WPS, WMS services

Leaflet v0.7X– Dynamic map rendered in web browser.

3.4.2.5 User Documentation

The application is mainly addressed to regular citizens. This implies that it has to be intuitive and easy to use. The preferred way of providing help will be in the form of tooltips. On-line help and tutorials will be considered, together with a user manual.

3.4.2.6 Assumptions

Already describe in state of arts and D4.2, D4.4.

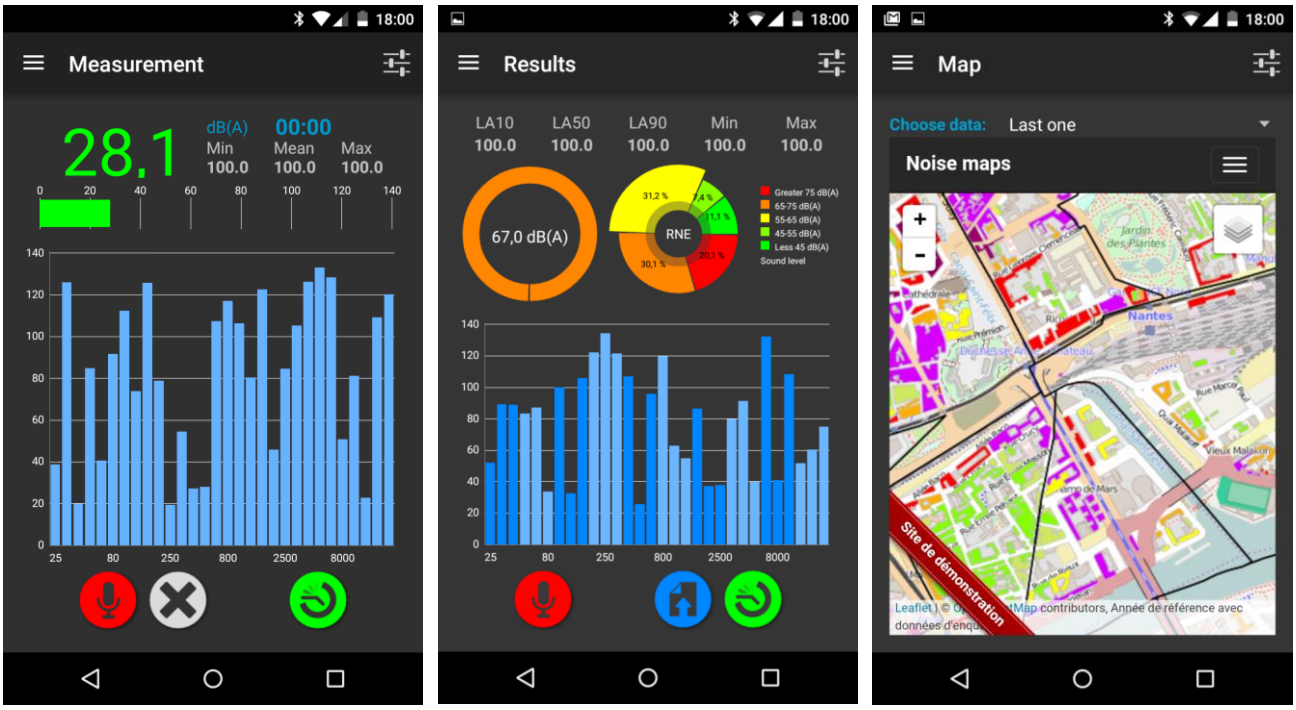
3.4.2.7 Constraints

The behaviour of the application must be consistent regardless of the used mobile device.

3.4.3 External Interface Requirements

3.4.3.1 User Interfaces

This window presents the NoiseCapture GUI.



(a) (b) (c)

Figure 15: Screenshots of the NoiseCapture application: (a) measurement screen, (b) results screen and (c) noise map visualization

3.4.3.2Virtual Hubs and Data Sources

The OnoM@p system is compliant with the Inspire Directive. It intends:

- to make data discoverable, by supporting standards for metadata and publishing through a discovery service
- to publish data through web services to be able to view and download the data

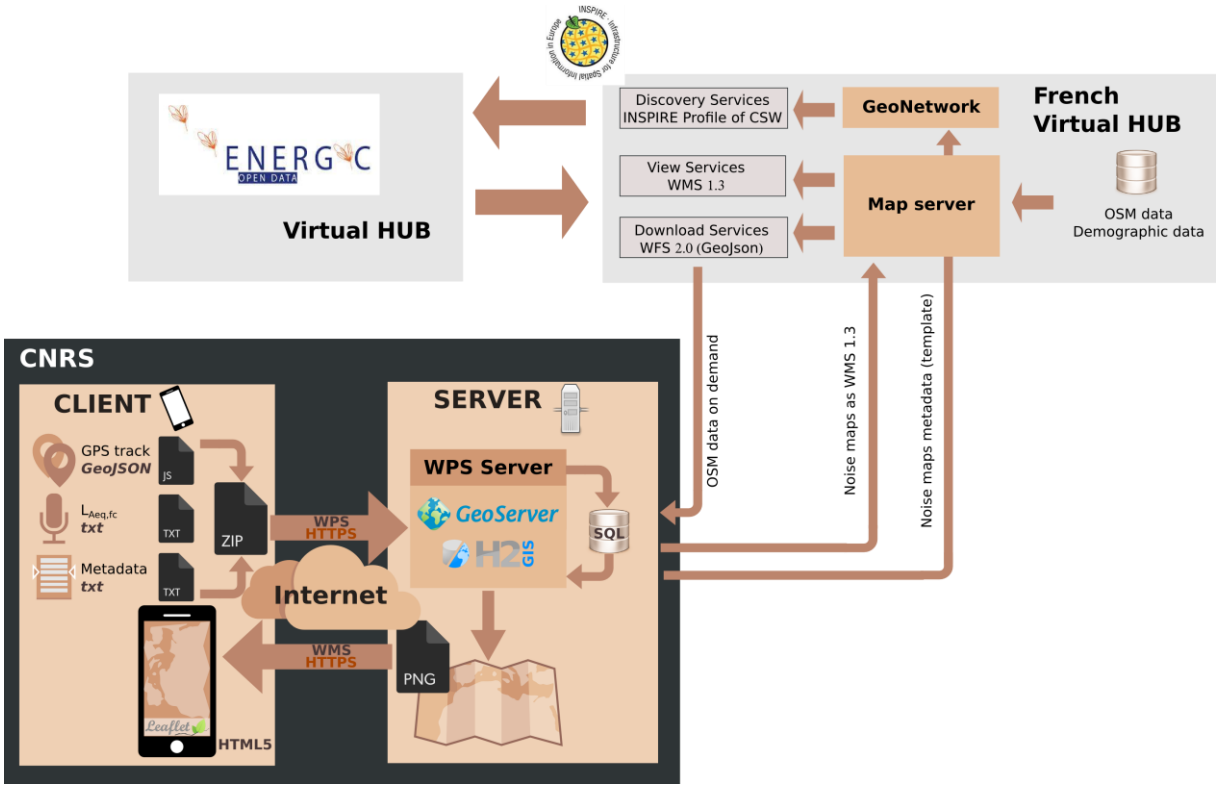


Figure 16: Standard formats and protocols involved in the communication of the smartphone application and the OnoM@p framework.

As the figure 16 shows the OnoM@p system is divided in two main parts.

- a client part that corresponds to the Android application called NoiseCapture,
- a server part that hosts the geoservices and the HTML map viewer.

See D4.1 (part 3 Data availability and access) for more details.

3.4.3.3 Communication Interfaces

The communication between software will be addressed with OGC standards using HTPP requests. The requests are embedded in the application and not yet available for the user, expected the Expert.

3.4.4 Functional Requirements

ID	F01A4
Requirement	Creates a VGI account
Priority	High
Use Case Reference	3.4.2.3.3.1 Create user account
Description	The VGI must set a username to install and run the NoiseCapture

ID	F02A4
Requirement	Start and stop the measure
Priority	High
Use Case Reference	3.4.2.3.3.2 Do a measure
Description	The VGI starts a measure. All the process is described in D4.2 (part 2.2 Smartphone application: NoiseCapture)

ID	F03A4
Requirement	Extract data from the noise database
Priority	High
Use Case Reference	3.4.2.3.3.3 Extract data
Description	The Expert is able to extract raw data from the database using a WPS request. See D4.1 “Processing part”.

ID	F04A4
Requirement	Browse all collected noise data and indicators
Priority	High
Use Case Reference	3.4.2.3.3.4 Browse maps
Description	A javascript web cartographic application is offered to display all collected data from the VGI and indicators computed by a geoprocessing chain.

ID	F05A4
Requirement	Manage all accounts
Priority	High
Use Case Reference	3.4.2.3.3.5 Manage accounts and services
Description	A user interface is offered to manage all services and accounts.

3.4.5 Non-Functional Requirements

ID	N01A4
Requirement	Run signal processing
Priority	High
Description	When the user stops the capture a signal processing algorithm is run to compute noise indicators. These indicators are automatically sent to the OnoM@p database.

ID	N02A4
Requirement	Run geoprocessing

Priority	High
Description	The collected data from the NoiseCapture application are aggregated automatically by a geoprocessing service available with the OnoM@p system.

ID	N03A4
Requirement	Publish maps
Priority	High
Description	The noise maps are published from the database to the web side using a set of WMS layers that used pre-configured Symbology Encoding styles.

3.4.6 Data Requirements

ID	D01A4
Requirement	Accuracy
Priority	High
Description	Noise measures must be valid before publishing it in WMS.

ID	D02A4
Requirement	Data access standards
Priority	High
Description	The noise indicators must be published in WMS and WFS (plus GeoJson).

ID	D03A4
Requirement	Data processing standards
Priority	Medium
Description	A WPS service must be available to extract raw data on demand.

3.5 ProxySanté (by DEPTH)

3.5.1 Introduction

In the health field, it appears more and more necessary to know precisely the care services available in the country.

Indeed, by the growing use of the web and making more data available, citizens are increasingly requesting reliable information on the care services available.

Moreover, the public authorities must implement rules of universal access to care. The new technologies make possible to quantify and qualify precisely care services available and cross them with data from different sources as population, buildings, other social or emergency services.

As part of the project ENERGIC OD, Depth France wants to build a web application that will offer new innovative services on this subject.

3.5.2 General Description

ProxySanté will provide a tool to localize and quantify accessibility to health services and simulate removal or new installation of health services.

3.5.2.1 Product Perspective

The software developed here can be used also in other domains like geomarketing, natural hazards and transportation. Indeed, isochrones are used to identify covered area by specific places whatever the field.

3.5.2.2 Product Functions

The application will propose to the user a form to select care service (doctor, pharmacy…) to analyze and a map to display the accessible areas in less than a given time. These areas are also called isochrones. The application will also show the number of inhabitant on this area.

The user will also be able to:

- Simulate the installation of a new service
- Simulate the removal of an existing service

3.5.2.3 User Characteristics

3.5.2.3.1 User Classes

- Public Authorities (end user)
- Professional geomatic community (using the API)
- Open data network (using the API)
- SME (Open Source application)

3.5.2.3.2 Relation of Users and System Components

3.5.2.3.3 Use Cases

User will be able to generate isochrones on a set of points of interest and to calculate the number of inhabitant on this area

User will be able to simulate the installation of a new service and calculate the number of inhabitant impacted

User will be able to remove an existing service and calculate the number of inhabitant impacted

3.5.2.4 Operating Environment

3.5.2.4.1 Hardware

The application will be hosted on two OVH servers. One for the frontal web and the other for the calculation of isochron maps.

Depth Frontal-Web Server:

Intel(R) Xeon(R) CPU E3-1245 V2 @ 3.40GHz
CPU: 8
RAM: 8192 KB
Speed: 2176 MHz

RAM 4 x 8192 MB
Disques 2 x 2000GB SATA
Kernel Version "Ubuntu 12.04.5 LTS" 3.10.23-xxxx-std-ipv6-64

Depth Calculation Server :
Intel(R) Xeon(R) CPU E3-1245 V2 @ 3.40GHz
CPU: 8
RAM: 8192 KB
Speed: 2176 MHz

RAM 4 x 8192 MB
Disques 2 x 2000GB SATA
Kernel Version "Ubuntu 12.04.5 LTS" 3.10.23-xxxx-std-ipv6-64

3.5.2.4.2 Software

The application will be developed with open source software:

- JOOMLA PHP Framework
- The php Laravel framework
- OpenTripPlanner
- Bootstrap library
- Leaflet library

3.5.2.5 User Documentation

The application is addressed to non GIS expert. This implies that the application has to be easy to use. We are going to create user interfaces in order not to have to perform training before users can use it. Specific ProxiSanté documentation will not be done.

3.5.2.6 Assumptions

The application will be pertinent only if we can access to high quality data:

- Roads Network
- Precise location of care services
- Location based people number

Generating isochrones can take a lot of times. We'll have to find a cache mechanism that will permit short response times.

3.5.2.7 Constraints

Principles constraints deal with the quality and quantity of data available under open data and

the ability for users to appropriate reading isochrones maps.

3.5.3 External Interface Requirements

3.5.3.1 User Interfaces

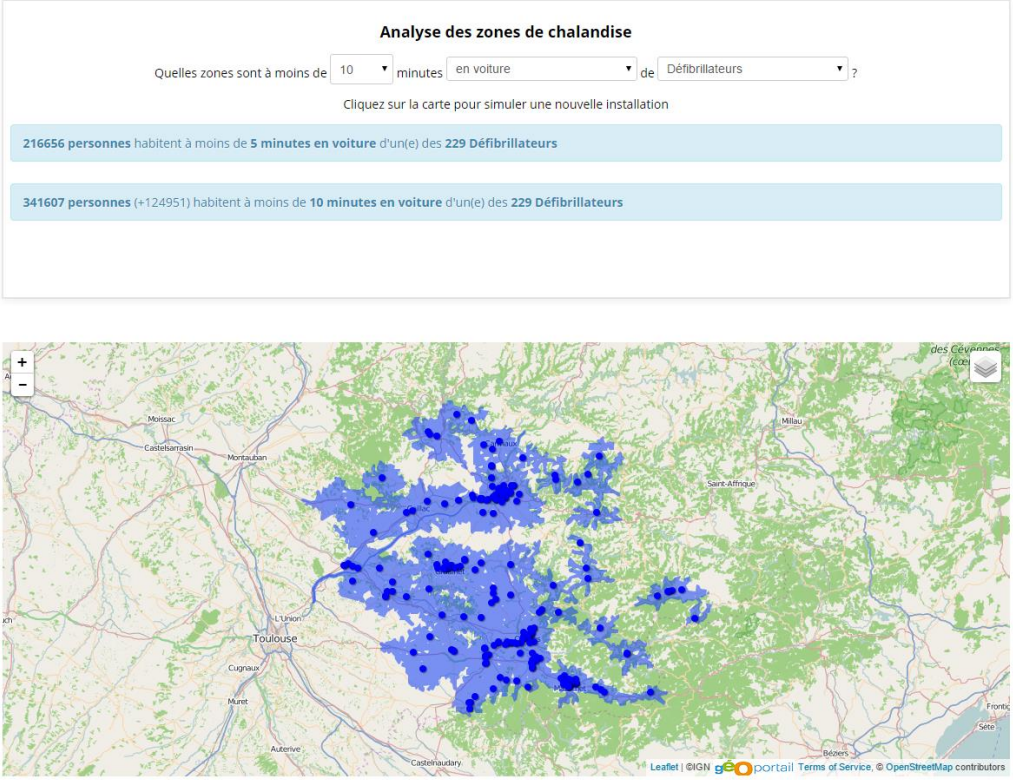


Figure 17: GUI of ProxySanté

3.5.3.2Hardware Interfaces

ProxiSanté will be hosted on two OVH servers interconnect throw json web services.

3.5.3.3 Software Interfaces

The application will be based on a JOOMLA component and will render the results on a Leaflet MAP based on EasySDI. It will use web services generated by OpenTripPlanner. Background layers will come from external web services as Geoportail API, OSM or Google Maps API.

3.5.3.4 Virtual Hubs and Data Sources

In terms of data we will use OpenStreetMap network data to calculate isochrones. Health services localization will be provided by public authorities (http://www.atlasante.fr). Inhabitant localization will be provided by INSEE (http://goo.gl/9veJlk).

We will also use the VH to convert GML provided by WFS services into GeoJSON format. We will implement some generical features in the VH as the number of inhabitant calculator.

3.5.3.5 Communication Interfaces

International standards will be used in ProxiSanté to feed and share data and isochrones: WFS, GeoJson, Json and standards http protocol.

3.5.4 Functional Requirements

ID	F01A5
Requirement	Visualisation
Description	Generating road graphs from OpenStreetMap and multimodal transport data

ID	F02A5
Requirement	Visualisation
Description	Generating isochrones maps from road graphs and KML POI files

ID	F03A5
Requirement	Data Processing
Description	Merging isochrones from several service into a single one

ID	F04A5
Requirement	Data Processing
Description	Calculating number of people living in the area of the isochrones calculated

ID	F05A5
Requirement	Visualisation
Description	Rendering isochrones and POI on a map

3.5.5 Non-Functional Requirements

ID	N01A5
Requirement	Accessibility
Description	Fast access to POI services standardized (KML)

ID	N02A5
Requirement	Performance
Description	Fast generated isochrones

ID	N03A5
Requirement	Usability
Description	User friendly interfaces

3.5.6 Data Requirements

ID	D01A5
Requirement	Content
Description	• OpenStreetMap data • Public transport data • Care service POIs • Location of population • Multimodal data

ID	D02A5
Requirement	Format
Description	• OSM – pbf file • Care service POIs – KML • Public transport data – GTFS file • Location of population – MIF/MID format

ID	D03A5
Requirement	External Systems

Description	• OpenStreetMap data
	  ○ http://download.geofabrik.de/
	• Care service POIs
	  ○ WFS: http://carto.atlasante.fr/cgi-bin/mapservwfs?service=WFS&request=GetCapabilities
	• Multimodal data
	  ○ http://data.ratp.fr/
	  ○ http://ressources.data.sncf.com
	  ○ https://data.toulouse-metropole.fr

3.6 Natural hazard assessment for agriculture (by IGIK)

3.6.1 Introduction

The main field of the IGiK's application are agriculture and natural hazards assessments.

It has the significant value for the farmer users like prediction of possible damages in agriculture caused by hazardous events such as draught, floods and frosts; assessment of the volume of crop yield reduction; prevention of loses.

The unique feature is that the application will use an original model of yield prediction based on the 17-years series of AVHRR satellite observations.

3.6.2 General Description

3.6.2.1 Product Perspective

The new application will take as main input the tables and maps generated by an IGiK system. The tables and maps are generated every 10 days from satellite information that, after a modelling stage, currently with manual supervision.

The modelling of phenomena processes will result with the spatial data which will be portrayed by the use of WMS and additional data will be provided in form of tables. The WMS functionality will be comparable with the existing solutions in the Web.

3.6.2.2 Product Functions

The Institute of Geodesy and Cartography (IGiK) developed the unique modelling research approach to the draught, frost and humidity phenomena spatial distribution as well as resulting in the yield forecasting. The installed at IGiK AVHRR satellite receiving station deliver every day the images covering whole country. The results of phenomena modelling based on these data in conjunction with other open satellite data are stored in the historical data database compound of 17-year long series.

The main goal of the application developed in the framework of the ENERGIC OD project is delivering this useful information to the community and to the general public, as well. This will be achieved by means of a web portal enabling awareness of possible crop yield reductions caused by identified natural hazards events.

A web application will allow stakeholders accessing to the forecasting information and information on the extent of each phenomena (draught, frost, humidity) in the form of maps and tables. By default, the last update of thematic data will be portrayed and the historical maps and tables will be also available from the database by the application.

In the web application, thematic data will be portrayed using appropriate background and reference data, which will be periodically uploaded to the VH location.

Stakeholders will be able to interact with the portrayed map and perform usual operations: zoom-in, zoom-out, full extent, zoom to a location identified through a place names search, play with a legend, etc.

3.6.2.3 User Characteristics

3.6.2.3.1 User Classes

The following kind of users can be distinguished:

- Farmer: a citizen with a particular interest in querying the latest prediction to plan his or her crops.
- Scientist: a more advanced user, also with basic computer skills but with environmental or scientific background, interested in browse the historical sets of predictions.
- Citizen: a regular user.

3.6.2.3.2 Relation of Users and System Components

Despite having established different kinds of users, no part of the application will have restricted access depending on the kind of user. It is expected that a farmer will be more likely to execute the part of the application corresponding to the “obtained current hazard prediction” use case, and that the use case “browse historical predictions” would be more interesting to scientists, but any user could use the system in the same way.

3.6.2.3.3 Use Cases

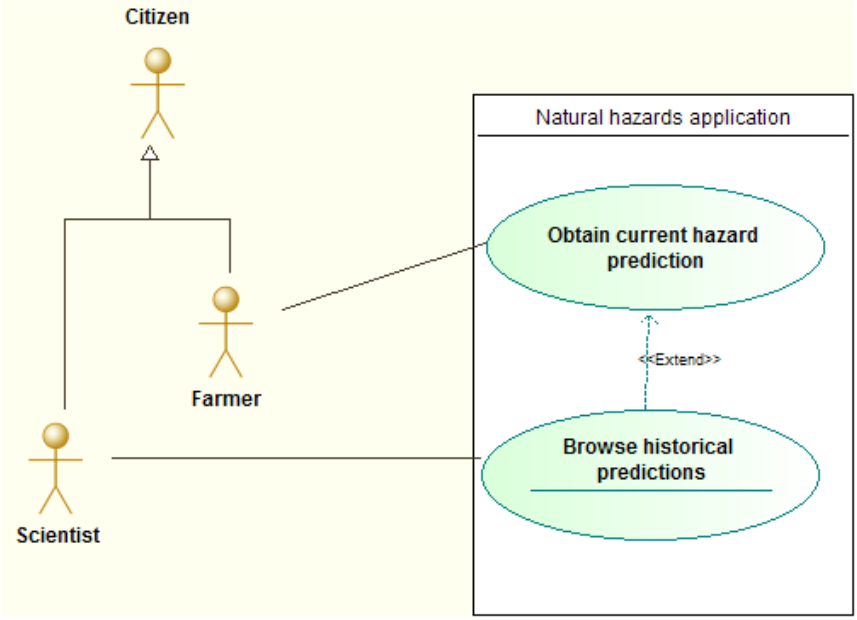


Figure 18: Use case diagram - Natural Hazards Application

3.6.2.3.3.1 Obtain current hazard prediction

Description:

The farmer is able to locate his or her parcel on the map with the help of the application, visualise the yield and drought prediction on a map (where the user is able to zoom in, out, move, set the map to the original display extent and print the map) and access additional information on the process of prediction.

Pre-conditions:

The user should access to the web page hosting the application with a web browser with JavaScript enabled.

Trigger:

The web browser has fully loaded the web page hosting the application.

Sequence of activities:

1. A map of Poland with the current prediction by county and other reference information appears.
2. The farmer locates his or her parcel by either a) browsing a map or b) providing the cadastral code of the parcel or the name of the commune the user is interested in.
3. In case b), the application zooms the map to the parcel, to a scale appropriate to visualise it together with part of its surroundings, and the user has general information about the yield and drought trends in the area.
4. The user interacts freely with the map by doing any of the following activities the number of time he or she desires, in the order he or she decides:
    - Zooming in the map around a point he or she signals
    - Zooming in the map around the centre of the displayed map.
    - Zooming out the map around a point he or she signals
    - Zooming out the map around the centre of the displayed map.

- Moving the displayed area of the map in any direction, maintaining the zoom scale.
- Setting the map to the original display extent.
- Printing the map.
- Requesting information (help and legend) on the aforementioned tools.
- Requesting information on the legend.
- Executing the *Browse historical predictions* use case.

5. The user access to the base information on yield and drought prediction in the county of his or her parcel, which is shown to him or her in a tabular form.

Post-conditions:

The user has been able to locate his or her parcel, and access to the corresponding yield and drought prediction, both as an interactive map and as a table.

Extensions:

3.6.2.3.3.2 Browse historical predictions.

3.6.2.3.3.2 Browse historical predictions

Description:

The user is able to access historical predictions of the yield and drought hazards, both in the form of maps and in the form of tabular data. The user is able to freely select the date of the historical prediction he or she wants to display among the existing ones.

Pre-conditions:

The user is executing the *Obtain current hazard prediction* use case

Trigger:

The user requests to browse the historical predictions

Sequence of activities:

1. A timeline or a list of available dates of prediction appears, allowing the user to select the date of the historical prediction he or she is interested in.
2. The prediction currently shown in the map changes to the one selected by the user.
3. The user interacts freely with the map by doing any of the activities stated in the steps 4 and 5 of the *Obtain current hazard prediction* use case the number of times he or she desires, in the order he or she decides.
4. The user can select another date or go back to the current prediction

Post-conditions:

The user has been able to access historical predictions of the yield and drought hazards, both in the form of maps and in the form of tabular data.

3.6.2.4 Operating Environment

3.6.2.4.1 Hardware

- **Polish SDI**
- **VH-PL**
  Web server for Virtual Machine implementation hosting the Polish VH.
- **IGiK infrastructure**
  Several workstations based on MS Windows operating system, basically applied for remote sensing and GIS processing as well as for implementation of the modelling software developed by IGiK.
- **UNIZAR infrastructure**
  If needed, servers to run specific services developed for the application.

- **Client**
  In order to run the application, users will need a regular computer, with no particular hardware restrictions.

3.6.2.4.2 Software

The modelling component uses the following software:

- ERDAS Imagine v. 9.2 – software for image processing of satellite data
- ArcGIS v. 10 – software for mapping
- QGIS – software for GI processing
- MS Access 2010 – for satellite data repository (18-years of observations)
- home developed software for modelling of crop yields

The Polish VH is running on VMware vSphere 5.0.0 as an instance of the GI-suite Brokering Framework.

The UNIZAR part of the solution is based on the following software:

- HTML5 & CSS3 scripts
- JavaScript (with versions depending on the web browser; development will support its latest version 1.8.5)
- jQuery 1.8 + JQueryUI
- OpenLayers 2.12
- QGIS

In order to run the application, end users will need a web browser. The following browsers will be supported: Mozilla Firefox 4+, Google Chrome, Safari 6+, Internet Explorer 9+, Opera 11+. No other special characteristics are required.

3.6.2.5 User Documentation

The application is addressed to regular citizens. This implies that has to be intuitive and easy to use. The preferred way of providing help will be in the form of tooltips. On-line help and tutorials will be considered, together with a user manual, depending on the results of the usability and acceptance tests.

3.6.2.6 Assumptions

- *Future situations:* The manual supervision of data processing could be avoided in future, however the final information to be provided to farmers must be verified prior to release.
- *Developments in technology:* New satellites of the Sentinel family will provide more detailed and reliable data. They will be introduced to the IGiK modelling system dedicated to hazard identification and yields forecasting.
- Metadata are available for spatial data used from NSDI, however every 10-day set will be described after producing new data.
- The VH is capable of implementation of the required (new) functionality (access to SHP files through FTP to offer a WMTS)

3.6.2.7 Constraints

- The ENERGIC OD VHs must be part of the solution.
- Those derived from the integration of the application in existing infrastructures.

3.6.3 External Interface Requirements

3.6.3.1 User Interfaces

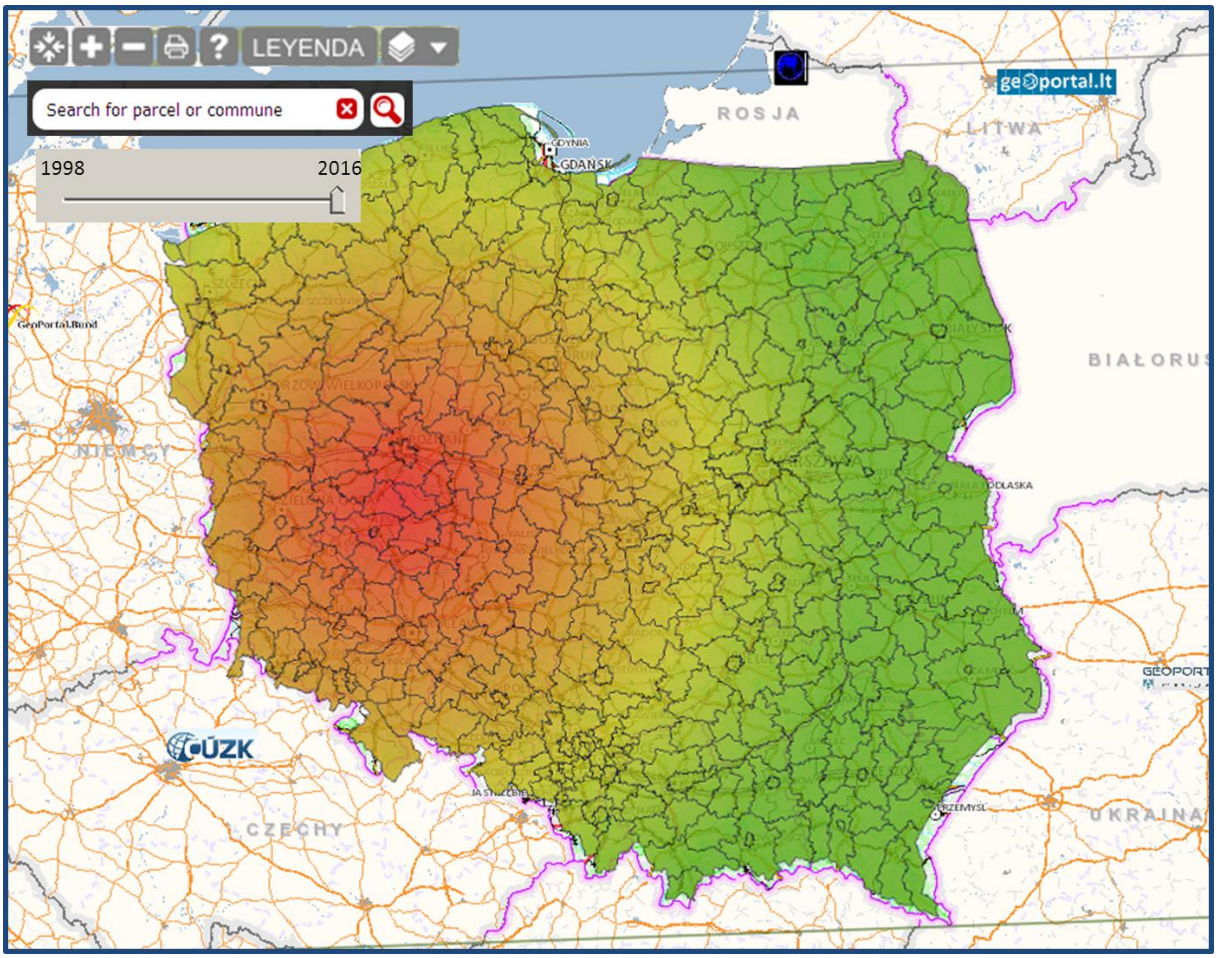


Figure 19: GUI prototype for the Natural Hazards Application

3.6.3.2Hardware Interfaces

The solution will be executed on different hardware components:

- The servers that compose the Polish SDI
- IGiK infrastructure used for remote sensing, GIS processing and execution of the modelling software developed by IGiK.
- The server where the VH-PL is hosted
- The user computer, where the application will run inside a web browser

All the interactions among the hardware nodes will be at software level and is described below in the following sections.

3.6.3.3 Software Interfaces

The only software interface not involving the VHs and other data sources involve the user browser interacting with the IGiK infrastructure geoportal web server to access and download the web page where the application is.

3.6.3.4 Virtual Hubs and Data Sources

Interactions between the user browser and the VH

- Requesting and receiving yields by county as maps
- Requesting and receiving yields by county as tabular data
- Requesting and receiving topography maps
- Requesting and receiving cadastral parcels
- Requesting geographical names and receiving locations, geometries or bounding boxes.

Interactions between the VH and IGiK infrastructure

- Requesting and receiving polish counties as maps
- Requesting and receiving yields by county as tabular data

Interactions between the VH and Polish SDI

- Requesting and receiving topography maps
- Requesting and receiving cadastral parcels
- Requesting geographical names and receiving locations, geometries or bounding boxes.

3.6.3.5 Communication Interfaces

Interaction between the user browser and the IGiK infrastructure: HTTP

Interactions between the user browser and the VH

- Requesting and receiving yields by county as maps: WMTS
- Requesting and receiving yields by county as tabular data: FTP
- Requesting and receiving topography maps: WMTS
- Requesting and receiving cadastral parcels: WFS
- Requesting geographical names and receiving locations, geometries or bounding boxes: WFS

Interactions between the VH and IGiK infrastructure

- Requesting and receiving polish counties as maps: shapefiles through FTP or HTTP
- Requesting and receiving yields by county as tabular data: FTP

Interactions between the VH and Polish SDI

- Requesting and receiving topography maps: WMS
- Requesting and receiving cadastral parcels: WFS
- Requesting geographical names and receiving locations, geometries or bounding boxes: WFS

3.6.4 Functional Requirements

ID	F01A6
Requirement	Visualisation: User access to a map of Poland with the current prediction by county and other reference information appears
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction
Description	User access to a map of Poland with the current prediction by county and other reference information appears

ID	F02A6
Requirement	Selection of data: The farmer locates his or her parcel by providing the cadastral code of the parcel or the name of a commune.
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction
Description	The farmer provides the cadastral code of his or her parcel or the name of a commune. The application zooms the map to the parcel, to a scale appropriate to visualise it together with part of its surroundings. The user obtains general information about the yield and drought trends in the area

ID	F03A6
Requirement	Navigation
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The user has tools to navigate freely in the map: zooming, panning or moving to the original extent

ID	F04A6
Requirement	Printing
Priority	Low
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The user has a tool to print the current view of the map.

ID	F05A6
Requirement	Legend and help
Priority	Low
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The user has a tool to query a help menu that shows off a legend and useful information in order to help users.

ID	F06A6
Requirement	Query, visualization
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The user access to the base information on yield and drought prediction in the county of his or her parcel, which is shown to him or her in a tabular form.

ID	F07A6
Requirement	Selection of data
Priority	High
Use Case Reference	3.6.2.3.3.2 Browse historical predictions
Description	A timeline or a list of available dates of prediction appears, allowing the user to select the date of the historical prediction he or she is interested in. Once one is selected, the prediction currently shown in the map changes to the one selected by the user.

ID	F08A6
Requirement	Change the background or base layer
Priority	Medium
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The user has a tool that offers the capability to change freely the base layer. The base layers available are the Polish SDI topographic map and Google Maps (satellite, map or hybrid).

3.6.5 Non-Functional Requirements

ID	N01A6
Requirement	Usability
Priority	High
Description	The solutions enable an intuitive and easy way of handling by users, especially easy map navigation.

ID	N02A1
Requirement	Usability. User help
Priority	Medium
Description	Help will be provided to the user mainly in the form of tooltips. On-line help and tutorials will be considered if during testing, difficulties of use appear.

ID	N03A6
Requirement	Accessibility
Priority	High
Description	All the web applications the Council offers through its web portal have to be accessible according to the Web Content Accessibility Guidelines (WCAG) 2.0 (W3C Recommendation 11 December 2008). This means that, to comply with the guidelines, alternative texts for the maps should be provided.

ID	N04A6
Requirement	Accuracy
Priority	Medium
Description	The solution provides visualization of data and results of data analysis of a high quality

ID	N05A6
Requirement	Maintenance
Priority	Medium
Description	The solution requires no or minimal redesign in case of new data, data sources, changed standards, interfaces or protocols.

ID	N06A6
Requirement	Scalability
Priority	High
Description	The solution will run as browser based application on many operating systems as possible.

ID	N07A6
Requirement	Usability
Priority	High
Description	The solution will run as browser based application on many operating systems as possible.

ID	N08A6
Requirement	Usability
Priority	Medium
Description	Outputs with information about warnings, errors, instructions and data sources for users have to be clear.

ID	N09A6
Requirement	Usability
Priority	Low
Description	The solutions have a multi-language support.

3.6.6 Data Requirements

ID	D01A6
Requirement	*Availability*
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The AVHRR and MODIS satellite data needed for the modelling are obtained by the IGiK satellite station every day and then normalised to 10 day time intervals.

ID	D02A6
Requirement	*Availability*
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	Background and reference data will serve for spatial data portraying and for processing with thematic data developed by the IGiK system.

ID	D03A6
Requirement	*Availability*
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	Gazetteer data will be based on the national dataset available for IGiK

ID	D04A6
Requirement	Accuracy
Priority	Medium
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	Accuracy of the georeferenced historical maps should be enough.

ID	D05A6
Requirement	Content
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The content of the maps will be yield and drought predictions.

ID	D06A6
Requirement	Coverage
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	The coverage of the yield and drought predictions will be Poland, with resolution at county level.

ID	D07A6
Requirement	Format
Priority	High
Use Case Reference	3.6.2.3.3.1 Obtain current hazard prediction 3.6.2.3.3.2 Browse historical predictions
Description	Yield and drought predictions will be georeferenced with the help of a shapefile to be served finally as a WMTS.

3.7 Biodiversity Bird Indicator (by LUP)

3.7.1 Introduction

The Biodiversity Bird Indicator (BBI) will be an application assessing the habitat requirements of indicator bird species for agricultural biodiversity monitoring - a tool to meet the 2010 biodiversity targets by analysing raster (satellite and aerial images) and vector data.

End users are able to request proposals for improvement of habitat structure. The essential feature for visualization is an interactive map, showing the results as a classification per land parcel. Thus farmers, public authorities and NGOs have direct access to information about structural deficits and can take target-oriented measures to optimize greening measures.

3.7.2 General Description

3.7.2.1 Product Perspective

The BBI will be based on a tier architecture, which is illustrated in figure 20.

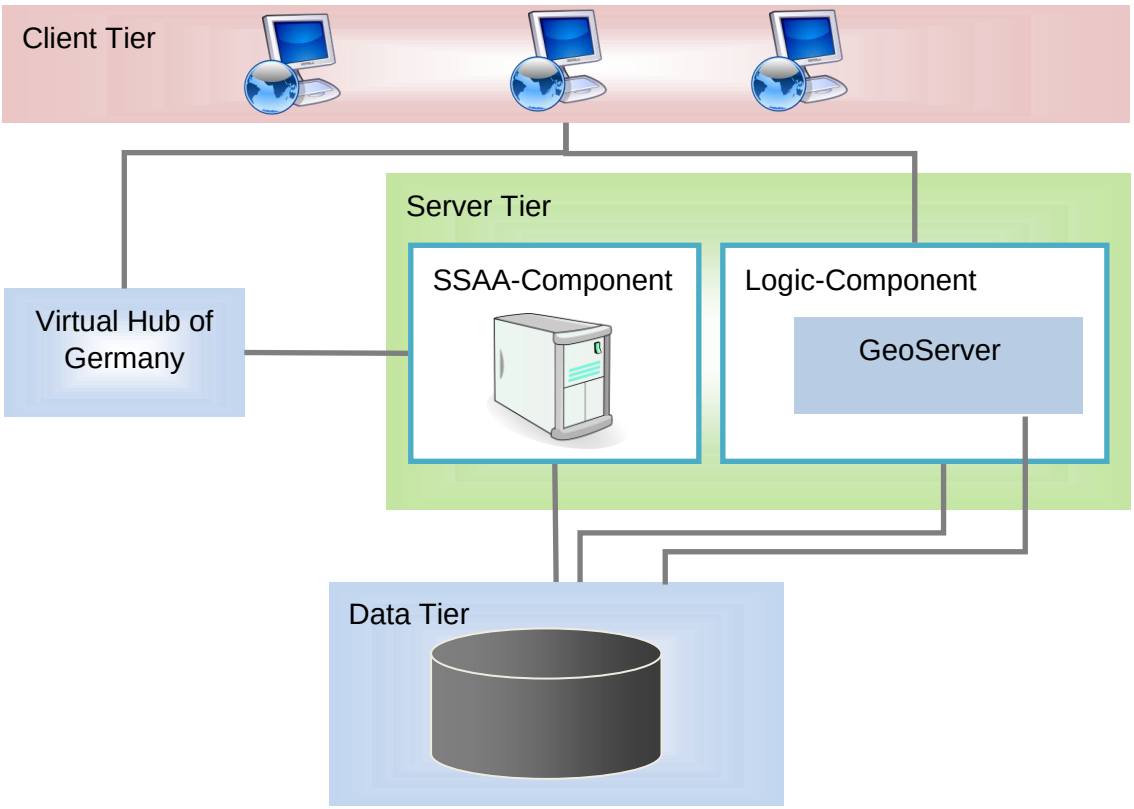


Figure 20: BBI system architecture

The **server tier** contains two components, the SSAA and the logic component. Based on remote sensing and image processing algorithms the SSAA component analyses geodata, provided by the VH of Germany, bird field data as well as habitat suitability parameters, which are stored in the data tier. The results of the geodata analysis will be stored in the data tier. The logic component controls the communication between the client and data tier. In addition, the logic component includes an entity of the GeoServer, which provides data of the data tier via

WMS and WFS to the client tier.

The **data tier** stores the bird field data, the habitat suitability parameters and user specific data.

A browser-based application builds the **client tier** and is the interface for end users. The client tier enables the request of the server tier as well as the VH of Germany.

The **VH of Germany** is used to access on open data, which will be visualised in the client tier and is needed to process biodiversity bird indicators in the SSAA component of the server tier.

3.7.2.2 Product Functions

The general functions of the BBI application are:

- visualization of data, (geodata and attribute data) as chart, table and layered map
- map-side data request to get area specific information
- map navigation by panning and zooming
- search for data by address data
- data filtering by time, spatial and semantic contents
- export of data as ASCII-text and PDF file
- processing of the biodiversity bird indicator features

In addition, the BBI application must fulfil objectives which can be classified as non-functional requirements. These objectives include the capability to provide data whose quality is good enough to enable the user of the BBI application to request correct information about the habitat suitable of a specific bird species. Furthermore, the application must be accessible by different user-side systems, as well as enabling an efficient and smooth workflow for the user.

In a close relation to the required functional and non-functional features of the BBI application are the actual data, which will be used to realise some of these stated requirements. Finally, the features of the data as well as the data sources impact the functional and non-functional requirement s of the BBI application.

3.7.2.3 User Characteristics

3.7.2.3.1 User Classes

Based on the available functions in the BBI application there are following four user classes:

1. The **visitor** is an anonymous user with limited access to functionalities of the BBI application.
2. The **registered user** is an authorised visitor with an extended access to BBI functionalities. The registered user originates from the visitor class.
3. The **developer** is a person who has detailed knowledge about processing of the biodiversity bird indicator and the technical architecture of the BBI application.
4. The **administrator** is part of the user class of developers and is the mediator between the visitors, registered users and the developers. For the administrator a detailed knowledge of the processing of bird habitat suitable and the technical architecture of the BBI application is not necessary.

Furthermore, each developer and administrator can be a visitor and registered user, e.g. to test

the BBI application after changes, which were made by developers.

For the development of the BBI application a set of potential end users is involved, on the one hand to create the concept of development and on the other hand to collect feedback about the prototype and the releases of the application in future. This set of users gets access to the functionalities of the class of registered users. Furthermore, there will be close collaboration between developers of the BBI and identified end users during the process of application development.

In general, the largest group of end users is the class of visitors. These users are anonym and will be considered as the source of registered users who can use the whole functionalities and information of the BBI application. After the main development period, the involvement of the developer class will decrease and the use by visitors and registered users will increase. The administrator will be involved at times.

3.7.2.3.2 Relation of Users and System Components

With the exception of the developers and the administrator all user classes have access to the BBI application, which is described in section 3.7.2.1, via the components of the client tier. The client tier provides a graphical user interface, which enables the access to the BBI functionalities for a specific user class.

For the maintenance, the redesign of the BBI application as well the processing of new data the developers can directly access to the components of the data and server tier.

3.7.2.3.3 Use Cases

The following use cases show the objectives and the resulting. All uses cases are referred to a running instance of the BBI application which is accessible via a client-side web browser.

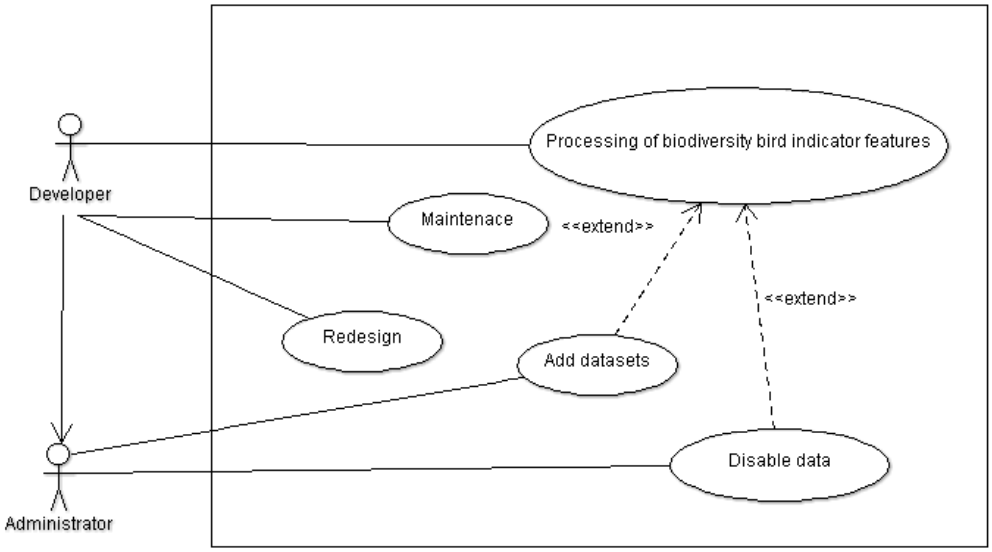


Figure 21: Administrator and developer use case diagram - BBI

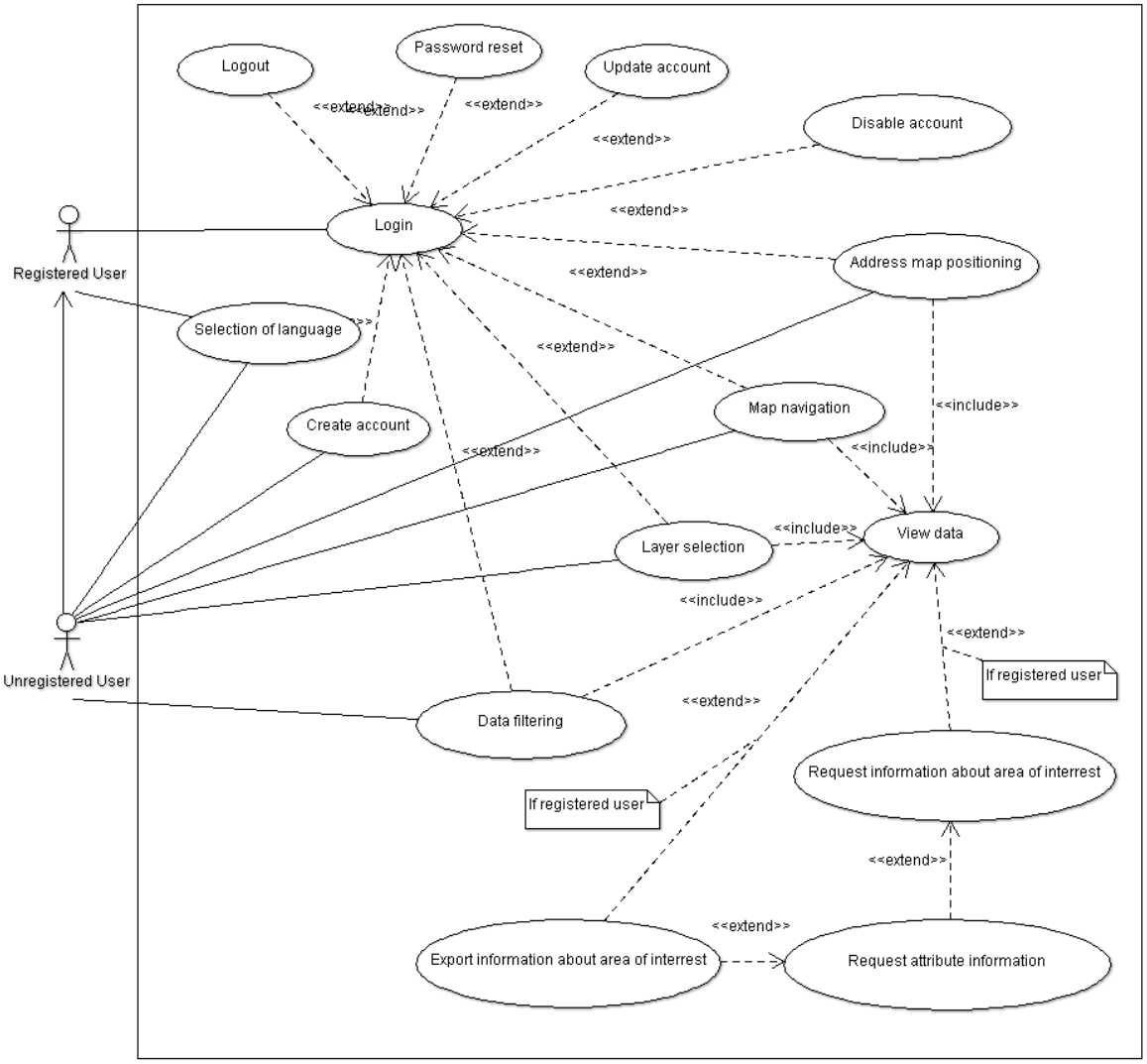


Figure 22: Registered user and visitor use case diagram - BBI

3.7.2.3.3.1 Login

Description	A visitor log in.
Pre-conditions	A visitor is not logged in and has a session.
Trigger	The visitor enters "username" and "password" and submits these entries to the server.
Sequence of activities	1. The server verifies the submitted entries. 2. The server updates the user session.
Post-conditions	A session is set to authorised and the user is logged in.
Extensions	Logout Disable account

3.7.2.3.3.2 Logout

Description	A user logs out.
Pre-conditions	The user has an authorised session.
Trigger	The user submits a logout request to the server.
Sequence of activities	1. The server updates the user session.
Post-conditions	A session is set to unauthorised and the user becomes a visitor.
Extensions	-

3.7.2.3.3.3 Create account

Description	A visitor creates an account for login.
Pre-conditions	The visitor is not authenticated as a user.
Trigger	The visitor requests the server to create a new user account.
Sequence of activities	1. The server provides a form in the GUI, which enables the visitor to enter its e-mail address, password, username as well as further contact information and confirms the terms of use. 2. The visitor submits the requested account values to the server 3. The server creates a new and disabled user account. 4. The server sends an e-mail to the visitor with the request of authentication via an embedded link. 5. The visitor uses the embedded link to verify the account. 6. The server enables the specific user account.
Post-conditions	A new enabled user account exists.
Extensions	Login

3.7.2.3.3.4 Disable account

Description	A user disables its account.
Pre-conditions	A user is logged in.
Trigger	The user requests the server to disable its account.
Sequence of activities	1. The server provides a form in the GUI, which enables the user to enter its password and username 2. The visitor submits the requested account values to the server 3. The server disables the specific user account and update the user session to unauthorised. 4. The user will be logged out.
Post-conditions	The user is a visitor.
Extensions	-

3.7.2.3.3.5 Data filtering

Description	The visitor or user can limit the data to be visualised to specific bird species and regions.
Pre-conditions	The visitor or user has a session for the BBI.
Trigger	The client requests the server with the selected filter values for one or more bird species and regions.
Sequence of activities	1. The server requests data according to the submitted filter values from the data tier. 2. The server processes a new data visualisation. 3. The server returns the new image and attributes data to the client. 4. The client visualises the new image as map and attribute data and/or as chart or table.
Post-conditions	The visitor or user sees the new data.
Extensions	View data

3.7.2.3.3.6 Address map positioning

Description	The user can centre the map view on a spatial position according to an address.
Pre-conditions	The visitor or user has a session for the BBI.
Trigger	The visitor submits a client-side entered address to the server.
Sequence of activities	1. The server requests the coordinate according to the submitted address from the data-tier. 2. The server submits the address coordinate to the client.
Post-conditions	The client-side map view will be centred on the coordinate and a marker will be shown at this specific position.
Extensions	View data

3.7.2.3.3.7 Map navigation

Description	The user can zoom and pan a graphical map.
Pre-conditions	The visitor or user has a session for the BBI.
Trigger	The user starts and client-side mouse event insight the map view.
Sequence of activities	1. The client requests the server with all current filter and layer values. 2. The server requests data from the data tier. 3. The server processes a new data visualisation. 4. The server returns the new image and attributes data to the client. 5. The client visualised the new image as map and attribute data as chart or table.
Post-conditions	The visitor or user sees a map view according to the mouse events.
Extensions	View Data

3.7.2.3.3.8 Layer selection

Description	The visitor or user selects the background layer of the visualised bird habitat information.
Pre-conditions	The visitor or user has a session for the BBI.
Trigger	The visitor or user selects a specific layer.
Sequence of activities	1. The server requests data from the data tier or external system, e.g. via VH. 2. The server processes a new data visualisation. 3. The server returns the new image data to the client. 4. The client visualises the new image as map.
Post-conditions	The visitor or user sees the new layer.
Extensions	View data

3.7.2.3.3.9 View data

Description	The visitor or user can see information about bird species as map, chart and table.
Pre-conditions	The visitor or user starts the BBI client-side and gets a session.
Trigger	The client requests the server.
Sequence of activities	1. The server requests data from the data tier. 2. The server processes a new data visualisation. 3. The server returns the new image and attributes data to the client. 4. The client visualises the new image as map and attribute data as chart or table.
Post-conditions	The visitor or user sees the new data.
Extensions	Request spatial information about area of interest (aoi)

3.7.2.3.3.10 Password reset

Description	The visitor creates a new password for a username.
Pre-conditions	The visitor knows the username of an associated and existing user account.
Trigger	The visitor requests the server to create a new password for a user account.
Sequence of activities	1. For the submitted username the server resets the old password by a new random password. 2. The server sends an e-mail with the new password to the associated e-mail address of the given username.
Post-conditions	The associated user is able to use the new received password for login.
Extensions	The user can update its account.

3.7.2.3.3.11 Update Account

Description	A user can update the values of its user account.
Pre-conditions	The user must be logged in.
Trigger	The user requests the server to update its account data.
Sequence of activities	1. The server provides a form in the GUI, which enables the user to enter its new e-mail address, password or username 2. The user submits the updated account values to the server 3. The server replaces the old values of the associated user account by the new values.
Post-conditions	An already existing user account has new values.
Extensions	-

3.7.2.3.3.12 Selection of language

Description	The visitor or user changes the language of the GUI.
Pre-conditions	For each GUI element a textual representation in the offered languages exists.
Trigger	The visitor or user selects a language.
Sequence of activities	1. The selected language will be submitted to the server. 2. The server provides the language specific information to the client.
Post-conditions	The elements of the GUI are presented with the specific language values.
Extensions	-

3.7.2.3.3.13 Processing of biodiversity bird data

Description	The developer processes biodiversity bird data.
Pre-conditions	All required satellite, field block and bird occurrences are available and accessible. A routine with the implemented biodiversity bird data algorithm exists.
Trigger	New data about field block and bird occurrences are available.
Sequence of activities	1. The developer configures the routine. 2. The developer starts the routine. 3. The routine requests the required data, e.g. from the VH, and process the biodiversity bird data.
Post-conditions	Results of biodiversity bird data processing exist as raster, vector and attribute data.
Extensions	Add data

3.7.2.3.3.14 Add data

Description	The administrator enables the provision of biodiversity bird data by the BBI application.
Pre-conditions	New biodiversity bird data exist.
Trigger	The decision to provide new biodiversity bird data.
Sequence of activities	1. The administrator informs the developers about the need of new biodiversity bird data. 2. The developers process new biodiversity bird data. 3. The administrator uploads the new data to the data tier. 4. The administrator configures the server according the new data 5. The administrator checks the BBI application for ability to run.
Post-conditions	The BBI application provides the new data.
Extensions	-

3.7.2.3.3.15 Disable data

Description	The developer disables the provision of biodiversity bird data by the BBI application.
Pre-conditions	Biodiversity bird data, which are provided by the BBI application, exist and have to be replaced.
Trigger	The decision to disable existing biodiversity bird data.
Sequence of activities	1. The administrator disables biodiversity bird data in the data tier. 2. The administrator configures the server according to the new data. 3. The administrator checks the BBI application for ability to run.
Post-conditions	The BBI application does not provide the disabled data.
Extensions	-

3.7.2.3.3.16 Maintenance

Description	The administrator configures, redesigns or checks the BBI application.
Pre-conditions	The BBI application is running on the server.
Trigger	The occurrence of feedback by visitors, users or the administrator itself.
Sequence of activities	1. The administrator informs the developers about errors or the need of new functionalities. 2. The developers redesign the BBI application. 3. The administrator configures the server and data-tier according to the changes by access to the configuration files of the specific BBI components. 4. The administrator checks the BBI application for ability to run.
Post-conditions	The BBI application is running on the server with new functionalities or a new configuration.
Extensions	-

3.7.2.3.3.17 Request spatial information about area of interest (aoi)

Description	The user wants habitat information for an aoi.
Pre-conditions	The user has a session and is logged in.
Trigger	The user selects a specific aoi on the map.
Sequence of activities	1. The client submits a request to the server with the position of an aoi. 2. The server determines the according entry in the data-tier. 3. The server submits the determined data to the client.
Post-conditions	The habitat information of the aoi will be shown client-side.
Extensions	Export information about aoi

3.7.2.3.3.18 Export information about area of interest (aoi)

Description	The registered user can export information about aoi as PDF or ASCII-text file.
Pre-conditions	The user has selected and requested the habitat information for a specific aoi.
Trigger	The user requests the client to export the shown habitat information of the aoi as PDF or ASCII-text file.
Sequence of activities	1. The client requests the server for additional information, e.g. map image, if PDF is selected as export format, for the according aoi. 2. The server submits the requested information to the client. 3. The client processes and provides this information in the selected file format.
Post-conditions	A file with habitat information exists client-side.
Extensions	-

3.7.2.4 Operating Environment

3.7.2.4.1 Hardware

Production server:

- Processor: Intel Xenon X3480, 3,06 GHz
- RAM: 16 GB
- Disk Space: 2 TB SATA
- Operating System: Windows Server 2008 R2 SP1, 64 Bit

Environment of development and data processing:

- Processor: Intel(R) Core(TM) i5-4460, 3.20GHz
- RAM: 8 GB
- Disk Space: 1 TB
- Operating System: Windows 7 Professional SP1, 64 Bit

3.7.2.4.2 Software

Technologies for the remote sensing and ecology analysis:

- ArcGIS 10.1
- ENVI 5.0
- ERDAS Imagine 2013/2015
- R 3.2.3
- Maxent 3.3.3.k

Technologies for the implementation of client, server and database components:

- OpenLayers 3
- GeoServer 2.8.1
- PostgreSQL 9.3 with PostGIS 2.1 extension
- jQuery 2.x
- PHP 5.4
- HTML5
- CSS3
- Apache HTTP Server 2.4
- API of VHs

3.7.2.5 User Documentation

For each user classes there will be a customized documentation. A technical documentation about the architecture and the components of the application will be created for the developers and the administrator.

A manual for visitors and registered users will be created explaining the functions and the workflow insight the GUI, which enables the interaction between these user classes and the BBI application. This documentation will be provided as a kind of online help, which is accessible by the GUI. In addition, the function of the GUI will be extended by a tooltip for each visualised component.

Each kind of documentation will be based on ISO 9001:2008 and will be provided as PDF and HTML website.

3.7.2.6 Assumptions

- For an exact visualization and analysis all required data are available and represent information of a same period.
- The VH of Germany is operative and provides required data.
- The licence of used data and technologies, e.g. libraries, will not be changed during the period of implementation. Excepting the implementation of the SSAA component, the implementation is based on open source technologies.
- In the future of the BBI application GeoTIFF might be replaced by JPEG2000 to process the biodiversity data

3.7.2.7 Constraints

- Bird biodiversity indicator data can be limited by the license of non-open data used in developing the indicator. Changes in license can affect the future use of data. In the same way standards of data interfaces can be changed.
- Failures or shutdowns of sensors, like sensors in satellites, can affect the availability or quality of data.
- Because the data storage of the BBI-system is limited not all available and needed data can be saved for the full term of data processing, this affects temporal data storing.

3.7.3 External Interface Requirements

3.7.3.1 User Interfaces

The visitors and registered users interact with the BBI application by a client-side GUI. The GUI enables the execution of the use cases related to these two user classes. The interaction between visitors or registered users and the BBI applications will be realised by keyboard and mouse events, which occur insight the client-side browser, where the GUI will be executed.

In general, the GUI enables the visitors or registered users of the BBI application to make inputs by mouse or keyboard, which will be translated to server requests. According to these requests the server responds and submits data to the client, which will be visualised and result in a modification of the GUI view for the specific user. This new GUI view enables the user to access further interactions with the BBI application. In addition to the interaction between user and GUI there are server-side interactions with the user. This interaction is based on the functionality that a visitor of the BBI application can be authorised and become a registered user. For this a verification e-mail will be send by the server to the user.

3.7.3.2 Hardware Interfaces

Related to the architecture of the BBI system, which is described in section 3.7.2.1, there is a client-side device with the capability to store temporary data. The client-side hardware must be in accordance to the system requirements of at least one of the current established browser (Internet Explorer, Mozilla Firefox, Opera, Safari, Google Chrome).

On the server-side there will be two hardware systems, one server system which provides the BBI application and one system which will be used to process the biodiversity bird data. The temporary results of the processing of the biodiversity bird data will be stored on the SSAA system, the final results of this processing will be stored on the server which provides the BBI application. This means that the processing of the biodiversity bird data does not affect the system, which provides the application itself.

3.7.3.3 Software Interfaces

In respect of the assumption that the VH of Germany provides the required data, the BBI application has no further interfaces to other external software components.

3.7.3.4 Virtual Hubs and Data Sources

The BBI application includes a client-side and a server-side connection to the VH of Germany. The client-side connection will be used to request aerial images and OSM data (OSM hill shade and street data) as background layer of the user-related map view. These data will be

requested as PNG or JPEG.

The server-side connection comes from the SSAA component, which processes the biodiversity bird data. The component uses the VH to get satellite images as GeoTIFF or JPEG2000 and the land parcels as shapefile. In addition to these server-side requested data itself, the according metadata are required.

3.7.3.5 Communication Interfaces

The following communication interfaces between the BBI application and external systems exists:

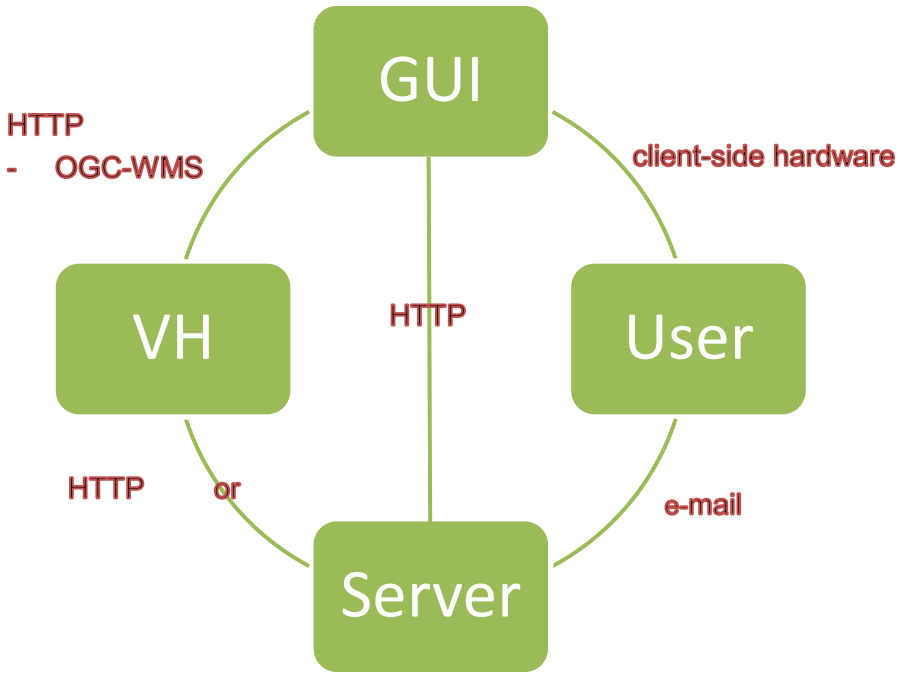


Figure 23: BBI communication interfaces

3.7.4 Functional Requirements

In the following the functional requirements of the BBI application will be presented. For each functional requirement the use cases which will be affected by the specific requirement will be stated as well as the priority of implementation. The priority of implementation is orientated on the required functionalities of the first prototype of the BBI application. All functionalities which must be realised to show the general operation of the application have the status “high”.

ID	F01A7
Requirement	Login
Priority	High
Use Case Reference	3.7.2.3.3.1 Login
Description	Enabling the access to BBI functionalities of the registered user.

ID	F02A7
Requirement	Logout
Priority	High
Use Case Reference	3.7.2.3.3.2 Logout
Description	Disabling the access to BBI functionalities of the registered user.

ID	F03A7
Requirement	Create account
Priority	High
Use Case Reference	3.7.2.3.3.3 Create account
Description	Create a new account for a registered user, who is able to use the extended functionalities of the BBI.

ID	F04A7
Requirement	E-mail sending
Priority	Medium
Use Case Reference	3.7.2.3.3.3 Create account
Description	During the process of account creation an e-mail will be send to the new registered user to verify its existence.

ID	F05A7
Requirement	Client-side validation
Priority	High
Use Case Reference	3.7.2.3.3.3 Create account 3.7.2.3.3.11 Update account
Description	During the creation of an account for a registered user the user specific entries in a client-side form, e.g. e-mail address, will be checked for valid values.

ID	F06A7
Requirement	Server-side validation
Priority	Medium
Use Case Reference	3.7.2.3.3.3 Create account 3.7.2.3.3.11 Update account
Description	During the creation of an account for a registered user the submitted user specific entries to the server, e.g. e-mail address, will be checked for valid values.

ID	F07A7
Requirement	Web Service
Priority	High
Use Case Reference	3.7.2.3.3.9 View data
Description	The BBI includes OGC WMS and WFS to provide the biodiversity bird data for the client-side components.

ID	F08A7
Requirement	Session support
Priority	High
Use Case Reference	3.7.2.3.3.1 Login 3.7.2.3.3.2 Logout 3.7.2.3.3.17 Request spatial information about area of interest (aoi) 3.7.2.3.3.18 Export information about aoi
Description	Users of the BBI are tracked over the HTTP protocol with, which enables the differentiation of visitors and registered users.

ID	F09A7
Requirement	Data filtering
Priority	Medium
Use Case Reference	3.7.2.3.3.5 Data filtering
Description	The user can limit the data to be visualised to specific bird species and regions.

ID	F10A7
Requirement	Address map positioning
Priority	Low
Use Case Reference	3.7.2.3.3.6 Address map positioning
Description	The user can centre the map to a select address.

ID	F11A7
Requirement	Map navigation
Priority	High
Use Case Reference	3.7.2.3.3.7 Map navigation
Description	The user can pan and zoom the map by the use of components of the GUI, the keyboard or mouse.

ID	F12A7
Requirement	External data interface
Priority	High
Use Case Reference	3.7.2.3.3.9 View data 3.7.2.3.3.13 Processing of biodiversity bird data
Description	The BBI can request OGC conform WCS, WFS and WMS to get data for the client-side visualisation and the server-side processing of biodiversity bird data.

ID	F13A7
Requirement	Layer selection
Priority	Medium
Use Case Reference	3.7.2.3.3.8 Layer selection
Description	Enabling and disabling the visualisation of background layers in the client-side map.

ID	F14A7
Requirement	View data
Priority	High
Use Case Reference	3.7.2.3.3.9 View data
Description	Enabling the client-side representation of data as map, table and chart.

ID	F15A7
Requirement	Password reset
Priority	High
Use Case Reference	3.7.2.3.3.10 Password reset
Description	Enabling the reset of the password of a registered user.

ID	F16A7
Requirement	Update account
Priority	High
Use Case Reference	3.7.2.3.3.11 Update account
Description	Enabling the update of information of a specific registered user.

ID	F17A7
Requirement	Selection of language
Priority	Low
Use Case Reference	3.7.2.3.3.12 Selection of language
Description	Enabling to switch between different GUI languages, German and English are available in the prototype of the BBI.

ID	F18A7
Requirement	Processing of biodiversity bird data
Priority	High
Use Case Reference	3.7.2.3.3.13 Processing of biodiversity bird data
Description	Enabling the processing of biodiversity bird data according to the input data.

ID	F19A7
Requirement	Add data
Priority	High
Use Case Reference	3.7.2.3.3.14 Add data
Description	Enabling the adding of new biodiversity bird data.

ID	F20A7
Requirement	Disable data
Priority	High
Use Case Reference	3.7.2.3.3.15 Disable data
Description	Enabling the disabling of new biodiversity bird data.

ID	F21A7
Requirement	Configuration
Priority	High
Use Case Reference	3.7.2.3.3.16 Maintenance
Description	Enabling the configuration of the server and data-tier of the BBI.

ID	F22A7
Requirement	Request information about aoi
Priority	Medium
Use Case Reference	3.7.2.3.3.17 Request spatial information about area of interest (aoi)
Description	The user can request biodiversity bird data for a specific aoi.

ID	F23A7
Requirement	Export information about aoi
Priority	Medium
Use Case Reference	3.7.2.3.3.18 Export information about aoi
Description	The user can export the requested biodiversity bird data for a specific aoi as PDF or ASCII file.

ID	F24A7
Requirement	Tooltips
Priority	Low
Use Case Reference	-
Description	The components of the GUI provide additional information about its use to facilitate the interaction between user and GUI.

ID	F25A7
Requirement	Documentation
Priority	High
Use Case Reference	-
Description	By the GUI a textual documentation about the functionalities and use of the BBI GUI will be provided.

ID	F26A7
Requirement	Visualisation of errors
Priority	Low
Use Case Reference	-
Description	Occurring errors will be displayed for the user.

ID	F27A7
Requirement	Monitoring of errors
Priority	Low
Use Case Reference	3.7.2.3.3.16 Maintenance
Description	Errors will be logged server-side.

3.7.5 Non-Functional Requirements

In the following the non-functional requirements of the BBI application will be presented. The priority of implementation is orientated on the quality requirements of the first prototype of the BBI application.

ID	N01A7
Requirement	Accuracy
Priority	High
Description	The results of the SSAA have to be of high quality. Therefore, all information of the satellite images and other original data should be used.

ID	N02A7
Requirement	Availability
Priority	Medium
Description	The BBI has to be available 99,8% of the year, because customers need a reliable application. The SSAA will process quarterly new data for the BBI and summarize them in an annual indicator. Therefore, data like satellite images will be requested at least four times per year. Analysis results have to be provided permanently for the BBI. The BBI is able to run on all current established browsers (Internet Explorer, Mozilla Firefox, Opera, Safari, Google Chrome).

ID	N03A7
Requirement	Performance
Priority	Medium
Description	The BBI enables a smooth workflow for users. The performance of the SSAA depends especially on the amount of data to be proceeded and the target accuracy. The processing of data is focused on all components and interfaces which provide data, this shouldn't lead to large delays.

ID	N04A7
Requirement	Portability
Priority	High
Description	New data or providers of data could result in a modification of data itself, interfaces or protocols. This should not require a redesign of the BBI system.

ID	N05A7
Requirement	Scalability
Priority	Medium
Description	The SSAA is able to process a large as well as a small amount of data, for example by use of data clustering approaches.

ID	N06A7
Requirement	Usability
Priority	High
Description	The GUI of the BBI has to be clear, provides functional requirements and assists the user during the work flow.

3.7.6 Data Requirements

The following data requirements of the BBI application are closely related to the use cases. This means that the availability of data enables the realisation of specific functional requirements as well as the according use cases.

ID	D01A7
Requirement	Availability
Priority	High
Use Case Reference	3.7.2.3.3.8 Layer selection 3.7.2.3.3.9 View data 3.7.2.3.3.13 Processing of biodiversity data
Description	The data which will be used to process the biodiversity bird features must be available at least once per quarter. The data which will be used as background layer must be available permanently.

ID	D02A7
Requirement	Granularity
Priority	High
Use Case Reference	3.7.2.3.3.13 Processing of biodiversity data
Description	The data which will be used to process the biodiversity bird features must be spatially and temporally comparable.

ID	D03A7
Requirement	Coverage
Priority	High
Use Case Reference	3.7.2.3.3.8 Layer selection 3.7.2.3.3.9 View data 3.7.2.3.3.13 Processing of biodiversity data
Description	The data to be used for the BBI application must cover the state of Brandenburg, Germany.

ID	D04A7
Requirement	Content
Priority	High
Use Case Reference	3.7.2.3.3.8 Layer selection 3.7.2.3.3.9 View data 3.7.2.3.3.13 Processing of biodiversity data
Description	The processing of the biodiversity bird data requires multispectral and multitemporal satellite images, data about land use, biotope types, bird occurrence and land parcels. For these metadata about quality and recording time should must be available. As background layers of the client-side map visualisation OSM data and aerial images will be used.

ID	D05A7
Requirement	Accuracy
Priority	High
Use Case Reference	3.7.2.3.3.13 Processing of biodiversity data
Description	The quality parameters cloud cover and pixel failure of satellite data must be reduced to a minimum.

ID	D06A7
Requirement	Formats
Priority	Medium
Use Case Reference	3.7.2.3.3.8 Layer selection 3.7.2.3.3.9 View data 3.7.2.3.3.13 Processing of biodiversity data
Description	Preference of data format are: Satellite images: JPEG2000 or GeoTIFF Land parcels: shapefile OSM data: JPEG or PNG Aerial images: JPEG or PNG

3.8 Geopan Atl@s (by POLIMI)

3.8.1 Introduction

GeoPan Atl@s aims to tackle mainly sustainable urban and territorial development providing an SDI of historical cadastral and topographical maps of Lombardy region, integrated with modern geographic open data for 2 scopes:

1. Cultural: to raise the “consciousness of the landscape” as a source of welfare, culture, historical memory and identity. Necessity for European countries ‘to integrate landscape into its regional and town planning policies and in its cultural, environmental, agricultural,

social and economic policies' (European Landscape Convention. Council of Europe, 2000)

2. Technical: to introduce the use of historical information into the territorial planning process.

3.8.2 General Description

3.8.2.1Product Perspective

GeoPan Atl@s is a new solution developed in the contest of ENERGIC OD on the top of the Italian VH.

3.8.2.2 Product Functions

Geopan Atla@s APP (A8 in ENERGIC OD Dow) is an application designed to give rapid access to Open Data to actors in the field of territorial management.

There are two main ways to discover datasets by means of Geopan Atla@s APP by using the Italian VH:

1. **Free search**
2. **Profile search**

Once data are discovered the user can select which one he wants to visualize. Starting from this point on the user can perform a series of operation:

- Geolocation of positions and itineraries,
- Geolocation of photos,
- Calculate distances and areas,
- Change layer transparencies to compare multi-epoch raster and vector datasets,
- Use drawing (point, polygons and polylines) and annotation functions.
- Data produced by the user can also be downloaded as KML files.

3.8.2.3 User Characteristics

GeoPan Atl@s is addressed mainly to two groups of users:

1. Professionals: geologist, landscape planner and specialists.
2. Non-expert: citizens, tourists, etc.

3.8.2.3.1 User Classes

User Classes	Description
Guest Users	Access is without registration. This user group has access to general and freely accessible information about urban and territorial development
Administrators	Administrators take over the technical maintenance of the application. The configurations and parameters can be set in a browser on the desktop. An administrator has full access to all functions and services of the app and their configuration. For this purpose, administration tools do not have to be geared to mobile use.

Table 3: User classes of Geopan Atl@s

3.8.2.3.2 Relation of Users and System Components

The guest user can access the GeoPan Atl@s APP both via desktop and mobile. The guest user can search contents and discover datasets by means of the Italian VH:

1. Free search
2. Profile search

Once data are discovered the user can select which one he wants to visualize. Starting from this point on the user can perform a series of operation:

- Geolocation of positions and itineraries,
- Geolocation of photos,
- Calculate distances and areas,
- Change layer transparencies to compare multi-epoch raster and vector datasets,
- Use drawing (point, polygons and polylines) and annotation functions.

Data produced by the user can also be downloaded as KML files.

3.8.2.3.3 Use Cases

3.8.2.3.3.1 <Guest Users>

Diagram:

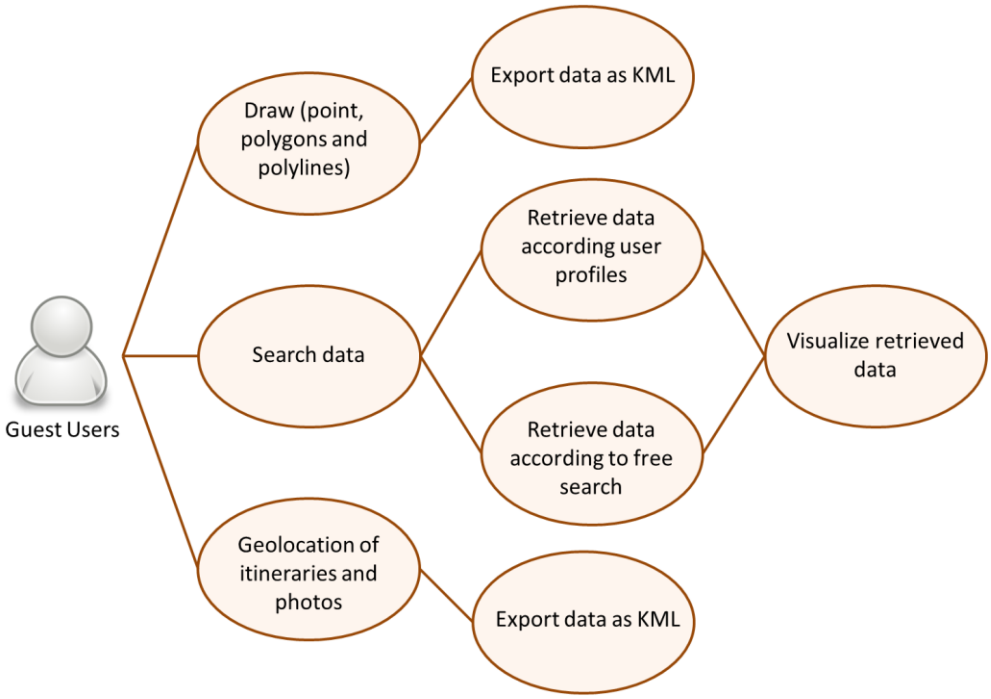


Figure 24: Use case diagram for Guest Users - Geopan Atl@s

Description:

A guest user has two main ways to discover datasets by means of Geopan Atla@s APP by using the Italian VH:

1. **Free search:** the user can perform a data request by using a free search box inserting specific keywords and possibly limiting the search by using temporal and spatial

constraints. If the keyword is found among the metadata - data they are recovered by the system.

2. **Profile search:** a set of user profiles is defined (e.g., geologist, landscape planner and specialists, etc.) and for each profile a set of semantic keyword is predefined. The profile search is also limited by a spatial extent. In the case the search is performed for a set of case study areas the output will be pre-processed datasets. The specific pre-processing and the added vale given to data depend on the specific requirement derived by the analysis of relevant "users groups" feedbacks. In the case the query is performed for areas not covered by the case study areas service either no data or raw information will be provided.

Once data are discovered the user can select which one he wants to visualize. Starting from this point on the user can perform a series of operation:

- Geolocation of positions and itineraries,
- Geolocation of photos,
- Calculate distances and areas,
- Change layer transparencies to compare multi-epoch raster and vector datasets,
- Use drawing (point, polygons and polylines) and annotation functions.

Data produced by the user can also be downloaded as KML files.

Pre-conditions:

The guest user has to access the Geopan Atla@s APP.

Trigger:

The guest user has to start the search, either free or based on profile based.

Sequence of activities:

The sequence of activities for a guest user to search datasets is presented in Figure 25.

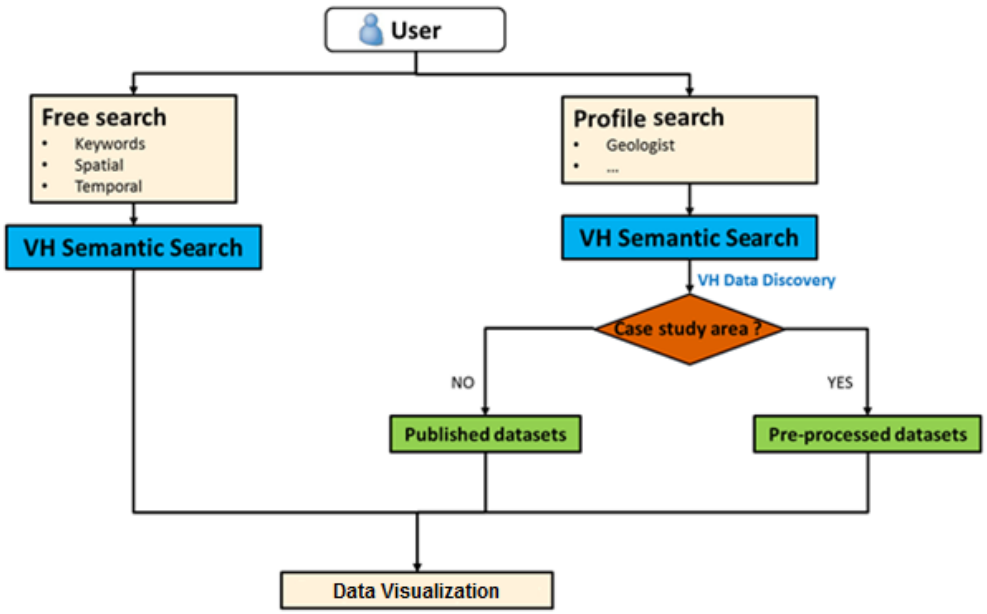


Figure 25: sequence of activities for a guest user to search datasets with the Geopan Atl@s APP

The sequence of activities for a guest user to produce and download datasets is presented in Figure 26.

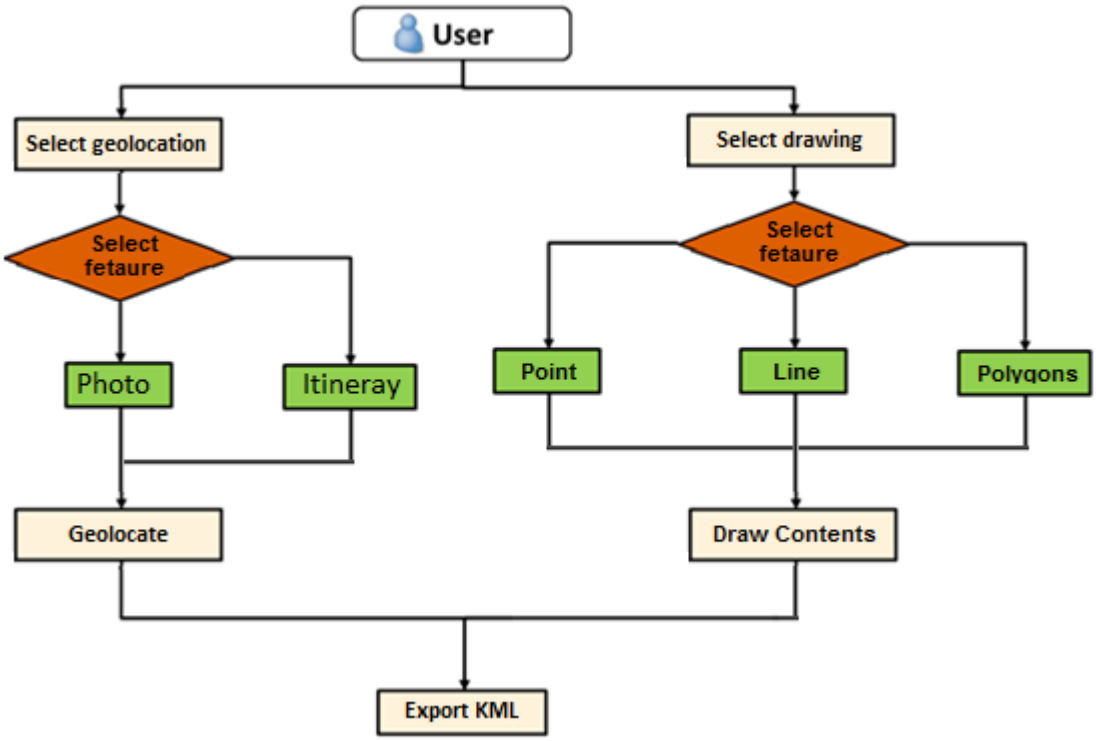


Figure 26: sequence of activities for a guest user to geolocate and drawing contents with the Geopan Atl@s APP

Post-conditions:

The condition after the search is the visualization of selected contents.

The condition after the geolocation and the drawing is the export of produced contents as KML.

Extensions:

N/A.

3.8.2.3.3.2 <Administrators>

Diagram:

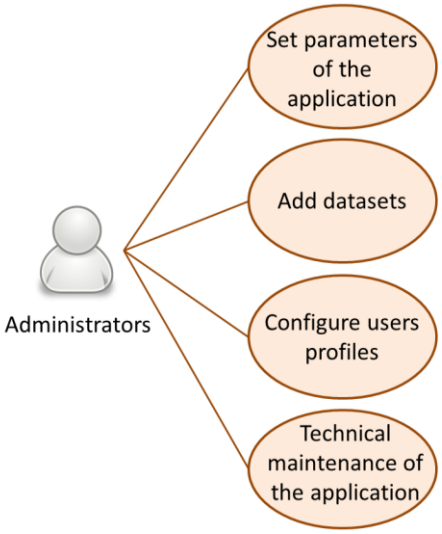


Figure 27: Use case diagram for Administrators - Geopan Atl@s

Description:

An Administrator is a user that can configure, update and maintain the GeoPan Atl@s APP. Main activities for an Administrator user are:

- technical maintenance of the application (e.g. update graphical interface, libraries, etc.),
- add further datasets with different formats and services,
- add and configure user profiles (define datasets to look for and pre-processing),
- access to all functions and services of the app and their configuration.

Pre-conditions:

New datasets or configuration parameters are available and/or an update of the GeoPan Atl@s APP is needed.

Trigger:

Access backend of the GeoPan Atl@s APP in a browser on the desktop.

Sequence of activities:

The different activities of an Administrator user (technical maintenance, dataset add, user profile add, app configurations) are preformed independently each other.

Post-conditions:

GeoPan Atl@s APP parameters are correctly configured.

New datasets are added.

New user profiles are defined.

GeoPan Atl@s APP is updated.

Extensions:

N/A.

3.8.2.4 Operating Environment

3.8.2.4.1 Hardware

Servers to store and publish data for case studies areas. Storage min. 300 GB.

3.8.2.4.2 Software

GeoPan ATl@s will be developed using the Apache Cordova technology (Phonegap).

Frontend/Interface will be developed as a classic HTML/CSS/JS approach by using the well-known library Jquery while the VirtualHUB library itself will be wrapped in specific classes (see diagram above). The application will be tested and deployed only on Android devices. However, by using the Phonegap package the possibility exists to bring the same application to other ecosystems such as iOS or Windows Phone with relative ease. A Microsoft Visual Studio 2015 solution will be provided as well as the source code. Following, a comprehensive list of the used frameworks and libraries:

- **Phonegap (Apache Cordova)**

PhoneGap is a free and open source framework that allows to create mobile apps using standardized web APIs for a very wide range of mobile platforms. License information can be found at http://phonegap.com/about/license/

- **giapi-1.2.9-beta**

VH javascript library. Required to interface the application with the VH. License information can be found at http://api.eurogeoss-broker.eu/

- **jQuery**

The jQuery 1.10.2 library will be used in order to develop the frontend (UI and application behaviour). Some jQuery plugins will be added such as blockUI, numeric, and zebra datepicker in order to enhance the user experience. License information can be found at http://jquery.com/ and as by license, directly in the included javascript files.

- **OpenLayers**

By design requirement, OpenLayers 2.x will be used as support to the giapi library in order to manage layers returned from queries. License information can be found at http://openlayers.org/two/

- **Geopan library**

In order to develop this application, a specific library will be developed that both handles the raw data from the VH and the application user experience.

An OpenLayer layer is wrapped as a GeopanLayer, which in turn is managed by the GeopanLayerManager – this allows for easy management via javascript for both the raw data and the visualization. Additional custom application behaviour is also defined in the Geopan.js, geolocation.js and GeopanSearchManager.js files.

3.8.2.5 User Documentation

A user documentation will be provided both in terms of on-line help and tooltips giving information about functionalities and delivery formats.

3.8.2.6 Assumptions

- Italian VH available and fully operative,
- Availability of API to interact with the VH,

- Availability of existing open source software and libraries to be used within the development of the Geopan Atla@s APP (e.g., map visualization, user interface interaction, etc.),
- Availability of open data for case study analysis,
- Availability of datasets with clear copyrights licenses (e.g., national archives datasets),
- Availability of licensing for publication of specific datasets available for downloading with registration and not as service.

3.8.2.7 Constraints

- ENERGIC OD DoW,
- Identify and specify supported processes with user group exactly enough.

3.8.3 External Interface Requirements

3.8.3.1 User Interfaces

The GeopPan Atl@s can be accessed both form desktop and mobile (Figure 28). The user may perform the following operations:

- Search data: from the search toolbox according both free and profile based search.
- Visualize data: once discovered data can be visualized and handled (add, remove and changed transparency) from a dedicated scroll bar
- Geolocate itineraries and photos by using a specific functionality in the options panel,
- Calculate distances and areas by using a specific functionality in the options panel,
- Use drawing (point, polygons and polylines) and annotation functions by using a specific functionality in the options panel.

Figure 28: Geopan Atl@s example of graphical interface

3.8.3.2Hardware Interfaces

Figure 29 describes the connection between the different components of GeoPan Atl@s. The connection between the GeoPan Atl@s will be performed by means of JavaScript web APIs. POLIMI Open Data are provided, processed and published by using GeoServer software.

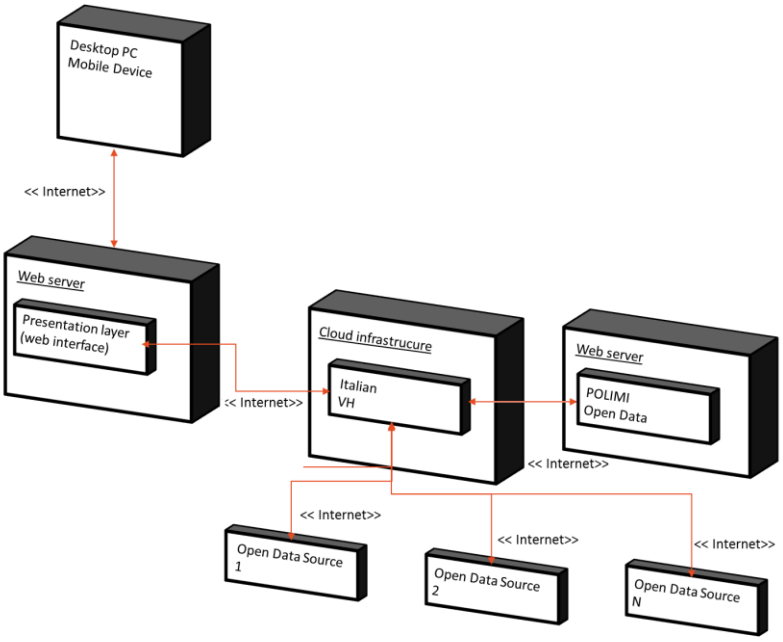
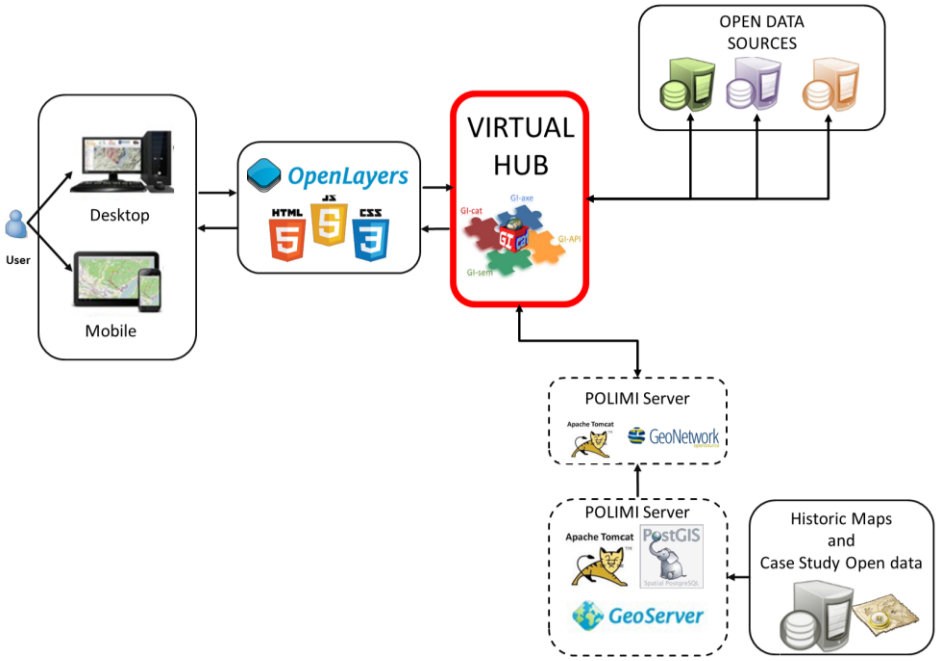


Figure 29: Geopan Atl@s APP hardware interface

3.8.3.3 Software Interfaces

GeoPan ATl@s will communicate with the Italian VH by means of JavaScript web APIs, while connection with data providers will be performed according to standard OGC standards. Figure 30 gives an overview of the different tier and their connection.



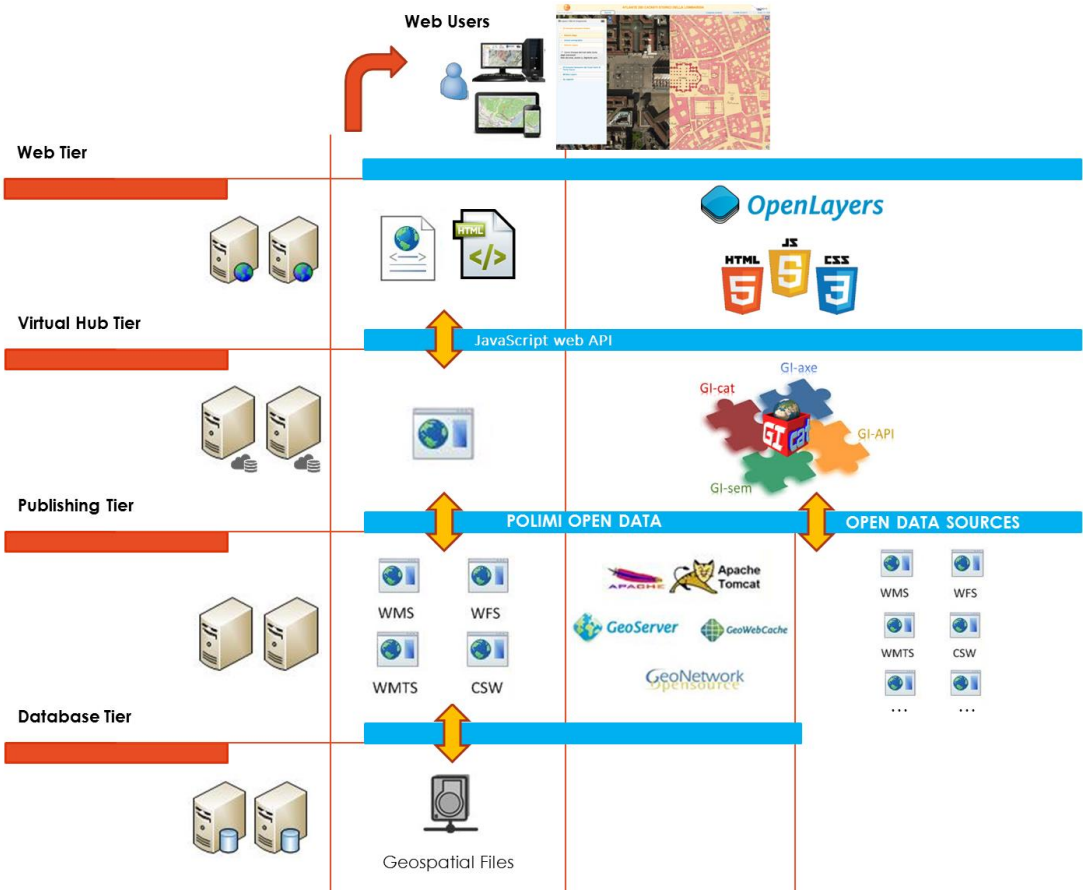


Figure 30: Geopan Atl@s APP multi-tier structure

3.8.3.4Virtual Hubs and Data Sources

The GeoPan Atlas will use a set of data sources provided with different service and file formats. In particular, data are provided as OGC standards (WMS, WFS, WCS, WMTS) or as SHP, KML, GeoTIFF files. These services and files have to be accessed through the Italian VH. A list of data sources used in GeoPan Atl@s is provide in D4.2 and D6.3.

3.8.3.5 Communication Interfaces

As previously described connection with Italian VH will be performed with JavaScript Web APIs, connection between data sources and the VH is performed by using OGC standards (WMS, WFS, WCS, WMTS) and the following formats: SHP, KML, GeoTIFF.

The GeoPan ATl@s can be accessed both via web browser (HTTP) and as app for Android devices.

3.8.4 Functional Requirements

ID	F01A8
Requirement	Visualisation
Priority	High
Use Case Reference	Guest
Description	Visualization of data (geo and attribute data)

ID	F02A8
Requirement	Navigation
Priority	High
Use Case Reference	Guest
Description	Map navigation by panning and zooming

ID	F03A8
Requirement	Query
Priority	High
Use Case Reference	Guest
Description	Data filtering by time, spatial and semantic contents

ID	F04A8
Requirement	User access
Priority	High
Use Case Reference	Administrator
Description	Configurable for various target groups and use cases

ID	F05A8
Requirement	Visualisation
Priority	High
Use Case Reference	Guest
Description	Display publicly available information on territorial development

ID	F06A8
Requirement	Selection of data
Priority	High
Use Case Reference	Administrator
Description	Add datasets with different formats and services

ID	F07A8
Requirement	Processing of data
Priority	High
Use Case Reference	Guest
Description	Export of data as KML files

ID	F08A8
Requirement	Processing of data
Priority	High
Use Case Reference	Guest
Description	Geolocation of positions and itineraries

ID	F09A8
Requirement	Processing of data
Priority	High
Use Case Reference	Guest
Description	Geolocation of photos

ID	F10A8
Requirement	Processing of data
Priority	High
Use Case Reference	Guest
Description	Calculate distances and areas

ID	F11A8
Requirement	Editing
Priority	High
Use Case Reference	Guest
Description	Drawing (point, polygons and polylines) and annotation functions

ID	F12A8
Requirement	Visualisation
Priority	High
Use Case Reference	Guest
Description	Change layer transparencies

ID	F13A8
Requirement	Maintenance
Priority	High
Use Case Reference	Administrator
Description	Access to all functions and services of the app and their configuration

ID	F14A8
Requirement	Maintenance
Priority	High
Use Case Reference	Administrator
Description	Update graphical interface of the application, libraries used and dependencies

3.8.5 Non-Functional Requirements

ID	N01A8
Requirement	Usability
Priority	High
Description	GeoPan Atl@as app shall be easy to use and the graphical user interface has to be clear

ID	N02A8
Requirement	Usability
Priority	High
Description	GeoPan Atl@as design is oriented on users without high expertise in mapping apps

ID	N03A8
Requirement	Usability
Priority	High
Description	GeoPan Atl@as enables a smooth workflow for users

ID	N04A8
Requirement	Accessibility
Priority	High
Description	Free access to free datasets shall be given to users

ID	N05A8
Requirement	Portability
Priority	High
Description	GeoPan Atl@as will be as flexible as possible to different devices and operating systems (Cross/Multi-platform)

ID	N06A8
Requirement	Maintenance

Priority	High
Description	GeoPan Atl@as his reliable and almost permanent reachable

ID	N07A8
Requirement	Maintenance
Priority	High
Description	GeoPan Atl@as can be easily maintained

ID	N08A8
Requirement	Scalability
Priority	High
Description	GeoPan Atl@as can be easily extended to new user profiles and to new case study areas

3.8.6 Data Requirements

ID	D01A8
Requirement	Accuracy
Priority	High
Use Case Reference	Guest
Description	Data are valid

ID	D02A8
Requirement	Coverage
Priority	High
Use Case Reference	Guest
Description	Pre-processed data have to be available for the case study area

ID	D03A8
Requirement	Coverage
Priority	Medium
Use Case Reference	Guest
Description	Data have to be available for Italy, Lombardy and Veneto regions

ID	D04A8
Requirement	Interfaces
Priority	High
Use Case Reference	Guest

Description	Data have to be provided in OGC standards (WMS, WFS, WCS, WMTS)

ID	D05A8
Requirement	Formats
Priority	High
Use Case Reference	Guest
Description	Data have to be provided in the following formats: SHP, KML, GeoTIFF

ID	D06A8
Requirement	Availability
Priority	High
Use Case Reference	Guest
Description	Data are reliable and almost permanent reachable

3.9 GEO*demos* (by SRP)

3.9.1 Introduction

The following product description is part of an iterative implementation process. In its present form, it reflects the state of development of the first iteration. Many questions are still unclear, especially with regard to the user interface and its functionality. In further iterations additions and changes are to be expected, especially after the delivery of the first prototype version and the user feedback (see schedule for “Task 6 - GUI-Design of Application” in D6.4).

GEO*demos*

The aim is to provide an application on the basis of open data, which can be used across Europe to evaluate selected aspects of living and housing quality for different places.

The challenge is not only to use the harmonized INSPIRE data but also “open” data with heterogeneous country-specific structures and content for such a review.

The provision of data by public administrations and governments as part of "open data" is a big step towards transparency and participation. But are the citizens also able to use this data to gain the necessary information for planning their lives?

We're not talking about the information products, such as maps or brochures that have always been created for the public. We talk about the basic data used for the preparation of these products!

These basic data are now available for download as "open" files and in many cases they cannot be interpreted by the layman. Often, multiple data sets are combined to generate the desired information (such as address data with geographical and demographic data).

For this purpose, the ordinary citizen is unable without corresponding GI systems.

Without knowledge of the data model sometimes even experts are stumped.

But the majorities of users are lay people and want to get information on mobile devices to

complex issues without having to use a GI system. The idea of the planned application is to prefabricate uniform information products from heterogeneous local data that can be used across Europe on mobile devices. For this purpose, uniform spatial references and semantically comparable data are needed. The success of this project is therefore dependent on the offerings of the country-specific open data portals.

As data sources will be tapped the offers of the country-specific open data portals and the INSPIRE themes.

Great hopes also depend on the results of the EU project E.L.F. (European Location Framework), which has announced the provision of interoperable reference data and services.

Scope

Before the "demos" became an administrative unit, for the ancient Greeks it was more or less just a housing and living community with a clear spatial demarcation, which was characterized by landscape features, flora, crafts and different heroes.

The proposed application GEO*demos* could support mobile European citizens to find a new place to live.

The Open Data and geo-portals of European states provide for this a variety of suitable data. (See chapter 3.9.6 “Data Requirements“)

Conceivable is the use of the application also in other fields of application, for example:

- in localization of new branches by pan-European company
- to support for political decisions at local and European level

A comparative assessment of residential sites in several European countries is not possible by the mere consideration of heterogeneous original data.

The original data are therefore aggregated on an abstract semantic level to a location profile.

In the evaluation of the sites different aspects are included as

- proximity to the city center,
- the environmental situation,
- the reachability of local recreational areas,
- etc.

(See also chapter 3.9.6 “Data Requirements“)

The aspects may be weighted differently by the user.

Unique features of this application are

- the methods of interdisciplinary combination of geographic and attribute data.
- as well as compilation of comparable location profiles based on heterogeneous data.

3.9.2 General Description

3.9.2.1 Product Perspective

The application GEO*demos* uses the technical infrastructure of the Local VHUB Berlin. This infrastructure includes all components that are necessary for the realization of the business model of the application. Some of these components have to be newly developed within the project ENERGIC OD. In addition, existing technologies are further developed, adapted and integrated.

GI Suite and GIS-BROKER provide the brokering functionality, such as Discovering and Access Services, as well as various value-added services. (See figure 31)

In addition, supporting Components are provided. These components are required to configure the function and data offer of VHUB Berlin and maintain the overall system.

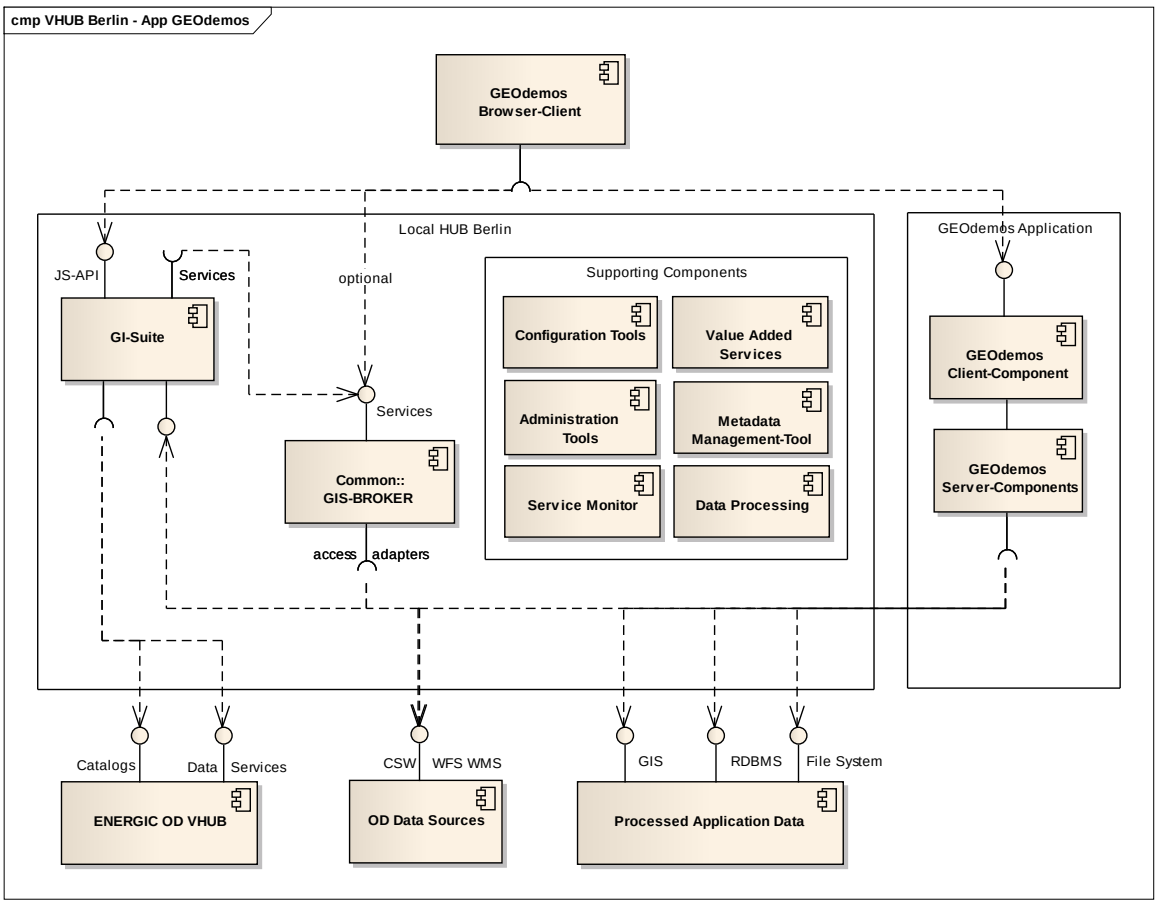


Figure 31: VHUB infrastructure for SRP application GEO*demos*

Application "GEO*demos*"

The application is designed as a client-server solution. It consists of an interoperable browser client and powerful server components.

The user interface of the client will be optimized for different types end devices, including for mobile phones. Preferably, the app will communicate with the VHUB Berlin via the JS API of GI-Suite. If required functions are not provided by the GI-Suite, the app can also directly access the GIS-BROKER.

GEO*demos* is a system-independent browser application. As far as possible the application processes are executed in the browser. However, some application functions require large amounts of data. In this case, the relevant processes are executed on the server.

GI-Suite

The GI-Suite will be used to discover the metadata that are provided by the other distributed VHUB of ENERGIC OD.

It is planned to realize a hierarchical communication structure. (See figure 32). At the current time, however, it is unclear how the metadata must be handled in order to avoid circular arguments and intolerable response time behavior.

If all metadata harvested by the European VHUB so GEO*demos* would have direct access to

this VHUB. In this case it is the task of the European VHUB, to avoid circular arguments and redundancies, and it could be the single point of contact for all VHUB.

Should the European VHUB take not this task, the GIS-BROKER would harvest all the metadata and provide it for GEO*demos*. In this case the GI-Suite would not be needed for the Local HUB Berlin to discover the metadata.

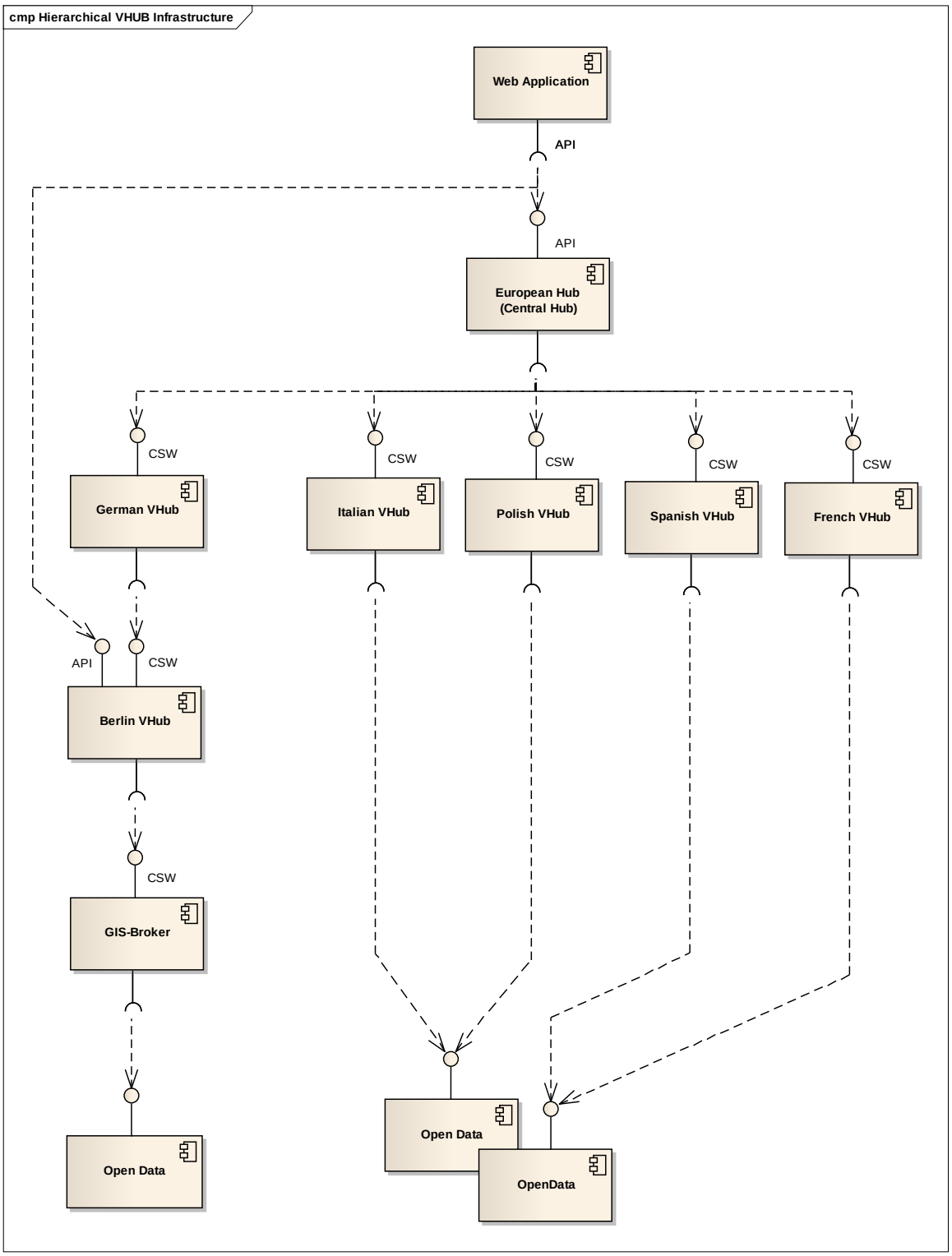


Figure 32: Hierarchical Structure of ENERGIC-OD - GEO*demos*

In any case, however, there is the plan to use the value-added services of GI-Suite (described in D5.1) such as

- Data Discovery (discovery of open data from specific data sources)
- Data Access (harmonized discovery and access to heterogeneous data systems)
- Data Processing (enriched discovery and access with processing and semantics services)

By means of the GI-Suite the data and metadata of the Local VHUB Berlin will be made available for the VHUB infrastructure ENERGIC OD.

GIS-BROKER

The investigations in WP3 have shown that the needed data are not available in the necessary quality and not in a comparable form. Therefore, some of the files are not directly integrated in the application via web services, but must be preprocessed first.

As described in D6.3, many of the open data are not available in the required format and quality. That's why some data which presented by the application are generated offline (preprocessing) from heterogeneous basic data by means of complex manufacturing processes.

These preprocessed data are stored in different systems (RDBMS, GIS, File System…) and made available by the GIS-BROKER via standardized services.

Supporting Components

In order to operate the application GEO*demos* sustainable, additional functional units are required, such as Tools for

- Pre-processing of data which are not available in the required formats and structures (Preparation of INSPIRE-compliant data structures)
- Configuration of the services, over which the processed data will be provided
- Management of user data
- ISO/INSPIRE compliant description of the prepared data provided by the VHUB Berlin
- Data validation (well-structuring, quality, up-to-dateness, completeness, …)
- Search and evaluation of data sources offered by OD portals (Exploration Bot)

If possible, some of these tools, such as data validation and exploration, also are made available in terms of value added services.

3.9.2.2 Product Functions

The functionality of the application GEO*demos* can be divided generally in backend and **frontend functionality.**

Backend functionality (data access and server processes)

- Access to web services (WMS, WFS)
- Mapping overlay and rendering
- Data filtering
- Sending feeds to registered user
- Service monitoring

- Validation of data quality
- Data description
- Application configuration

Frontend functionality (functions of the user interface)

- User Management
- Navigation
- Spatial and content-related research (address search, navigation on maps, search filter)
- Visualization of spatial and attribute data
- Map Layer Management
- Location based dossiers (view and export)
- Personalization (storage of personal settings)
- Export (e.g. print) / share reports
- Share of search results (email)

3.9.2.3 User Characteristics

3.9.2.3.1 User Classes

For the different user classes various configurations of the application will be provided which are optimized for different types of end devices. With regard to their different demands on the app the following user classes can be distinguished:

- Administrator
- Data Editor
- End User

For each of these user classes appropriate functionalities are provided:

Administrator (low usage intensity - high system stability)

- tools for maintenance and support of the application
- tools for backup of customer data
- tools for testing the performance
- tools for monitoring the services

Data Editor (periodic usage as a function of the rate of change)

- tools for maintenance of the metadata
- tools for testing the presentation of new data

User (high intensity of use)

- unregistered user (highest usage intensity)
  - search in data offering
  - localization of place of interest
  - visualization of the selected data
  - export documents
- registered user (high usage intensity)
  - personalization of usage profile (as an additional function)

The intensity of use refers to the amount of the user, not to the extent of data transmission.

Members of the user class "end-users" are:

Citizens who are looking for a new place of residence

- Families (interested in places with excellent social infrastructure, good neighborhood and child-friendly residential environment)
- Singles (interested in places with wide cultural offerings and a high level of urbanity)
- Students (interested in places with affordable housing)

Freelancer

- Urban planners (interested in inventory data as a basis for planning)
- Real estate agents (demand for environment information for the creation of a sales portfolio)

Companies

- For the case that companies interested in the quality of living of their employees, they can use the app directly.
- In order to explore the conditions for the establishment of a branch office or a new company headquarters, the information provided by the app is useful, but not sufficient. They need information on the economic framework conditions at their place of interest. This information is offered in numerous other portals of municipalities. If they are providing services data access will be integrated directly into the app GEO*demos*. Closed applications are accessed via a link. In a first step SRP negotiated about it with the operators of the Berlin Economic Portals.

3.9.2.3.2 Relation of Users and System Components

User Management:

- Registered User
- Administrator

Navigation:

- User
- Registered user

Spatial and content-related research:

- User
- Registered user

Visualization of spatial and attribute data:

- User
- Registered user

Map Layer Management

- User
- Registered user

Location based dossiers

- User
- Registered user

Personalization:

- Registered User

Export (e.g. print) / share reports

- User
- Registered user

Share of search results

- User
- Registered user

Validation of data quality

- Data Editor

Data description

- Data Editor

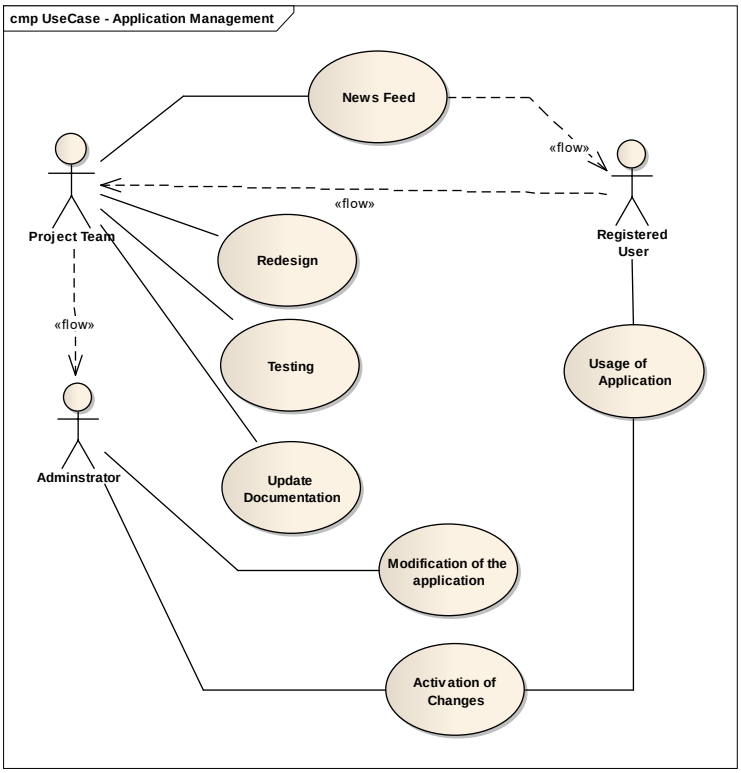
Application configuration

- Administrator

3.9.2.3.3 Use Cases

Administration

Use Case 01: Application Management

Diagram	 *Figure 33: Use case diagram 1* - GEO*demos*
Description	The application user interface is controlled by scenarios that are executed when the app starts. In order to adapt the user navigation accordingly the user feedback or to provide new features, the scenarios need to be edit.
Actor	Administrator
Pre-conditions	none
Trigger	– decision of Project Team
Sequences of activities	1. Redesign of application 2. Edit scenario 3. Test 4. Documentation of changes 5. Activation
Exception	none
Post-conditions	
if successful	Users can use the new interface with improved usability.
if unsuccessful	Further change of the scenario.
Extensions	none

User Management

Use Case 02: Login

Diagram	-
Description	The user wants to log in.

Actor	unknown User
Pre-conditions	– The application was started in a browser and works. – The user has access to the internet. – The authentication server is available.
Trigger	– User selects “login” command.
Sequences of activities	1. User selects “login” command. 2. The User is shown a query dialog 3. User enters the e-mail address and password. 4. User presses submit button. 5. Submitted details are validated. 6. Processing message is displayed to the User. 7. User is logged.
Exception	User presses the Exit or Back button at Step 2 or 3. The use case terminates with no action performed.
Post-conditions	-
if successful	User is logged in.
if unsuccessful	Wrong password: At step 5 the validation failed. User gets an error message “Wrong username or password” and is returned to Step 3 with the invalid field or fields highlighted. Unknown User: At step 5 the User was not found in the database. Login fails. An error message “User unknown” is displayed informing that firstly the User must register.
Extensions	Use case 03

Use Case 03: Create account

Diagram	-
Description	The user wants to create an account.
Actor	unknown User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The authentication server is available.
Trigger	– User selects “create account” command.
Sequences of activities	1. User selects “create account” command. 2. User enters name, e-mail address, password and password confirmation. 3. User presses submit button. 4. Submitted details are validated. 5. Processing message is displayed to the User. 6. New account is created in the database. 7. Success message is displayed to User
Exception	User presses the Exit or Back button at Step 3. The use case terminates with no action performed.
Post-conditions	-
if successful	New account is created in the database.

if unsuccessful	At step 4 the validation failed. User gets an error message and is returned to Step 2 with the invalid field or fields highlighted. At step 6 the creating of an account in the database fails. The User is informed and the use case terminates.
Extensions	none

Use Case 04: Close account

Diagram	-
Description	The user wants to close his account.
Actor	known User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The authentication server is available. – The User is logged into the system.
Trigger	– User selects “my account” command.
Sequences of activities	1. User selects “my account” command. 2. User selects “close account” command from the Account details screen. 3. The User is shown a Confirmation Dialog (Are you sure?). 4. User replies “YES”. 5. Processing message is displayed to the User. 6. Account is deleted in the database. 7. Success message is displayed to User.
Exception	User replies “No” at Step 3. A message is displayed confirming that nothing has been changed and the use case terminates with no action performed. User presses the Exit or Back button at Step 3. The use case terminates with no action performed.
Post-conditions	-
if successful	Account is deleted in the database.
if unsuccessful	At step 6 the deleting of the account in the database fails. The User is informed and the use case terminates.
Extensions	none

Navigation

Use Case 05: Navigation via Map

Diagram	-
Description	The user wants to find a location by use of the map.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The navigation map is presented – predefined map section

	– map section for GPS position
Trigger	– The User tips in the map.
Sequences of activities	1. He moves the finger over the display. 2. User navigates via “touch selection”, “panning”, “pinch zoom” command in the map.
Exception	none
Post-conditions	-
if successful	The user could navigate to the point of interest.
if unsuccessful	-
Extensions	none

Spatial and content-related research

Use Case 06: Navigation via address

Diagram	-
Description	The user wants to find a location via address in the map.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The address server and map server is available.
Trigger	– User selects “search by address” command.
Sequences of activities	1. User selects “search by address” command. 2. The user is shown a query dialog 3. User enters the address (at least 3 characters) 4. User presses submit button. 5. Submitted details are validated. 6. The map navigates to the entered address. 7. The address is highlighted in the map.
Exception	User presses the Exit or Back button at Step 2 or 3. The use case terminates with no action performed.
Post-conditions	-
if successful	The User gets the address shown.
if unsuccessful	Enters to few characters: At step 5 the validation failed. No address is shown. Unknown address: At step 5 the address was not found in the database. An error message “address unknown” is displayed informing that the User should try it again.
Extensions	-

Use Case 07: Locations via search filters

Diagram	-
Description	The user wants to find locations which correspond to the search criteria.
Actor	User

Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The address server and map server is available.
Trigger	– User selects “search by search filters” command.
Sequences of activities	1. User selects “search by search filters” command. 2. The User is shown a Query Dialog 3. User selects a search filter definition. 4. User presses submit button. 5. Submitted details are validated. 6. A list of possible locations is displayed.
Exception	User presses the Exit or Back button at Step 2 or 3. The use case terminates with no action performed.
Post-conditions	-
if successful	A list of possible locations is displayed. The User can select a location from the list.
if unsuccessful	There was no location found.
Extensions	-

Visualization of spatial and attribute data

Use Case 08: Visualisation of attribute data

Diagram	-
Description	The user wants to get some information about his selected location.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The user has access to the internet. – The address server and map server is available. – The user previously had selected a location. – The location is presented in the map.
Trigger	– The user tips on the location shown in the map.
Sequences of activities	1. The user tips on the location shown in the map. 2. The user is shown a Property Data Display. The user is shown a Property Data Display.
Exception	none
Post-conditions	-
if successful	Information found: The User is shown a Property Data Display with Detail Information about the location.
if unsuccessful	No information found: The Property Data Display is displayed informing that no information exists to the selected location.
Extensions	Use cases 06, 07

Use Case 09: Visualization of spatial data

Diagram	-

Description	The user wants to have his selected location displayed in the map.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The user has access to the internet. – The address server and map server is available.
Trigger	– First case: The User had selected a location via address. – Second case: The user selects a location from the result list of the use case 07.
Sequences of activities	First case: 1. The user selects a location via address. 2. The user confirms his selection. 3. The location is shown in the map. Second case: 1. The user selects a location from the result list of the use case 07. 2. The user confirms his selection. 3. The location is shown in the map.
Exception	none
Post-conditions	-
if successful	Location visualized: The location is shown in the map and highlighted.
if unsuccessful	No location visualized: The preconditions have not been met.
Extensions	Use cases 06, 07

Location based dossiers

Use Case 10: View location based dossier

Diagram	-
Description	The user wants to have all available information about his selected location.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The address server and map server is available.
Trigger	– The User selects the “show dossier” command.
Sequences of activities	First case: The user previously had selected a location. 1. The user selects the “show dossier” command. 2. The user is shown a Query Dialog. 3. The user selects all topics he is interested in. 4. The user confirms his selection. 5. The user gets a report for his selected location and topics. Second case: The User previously hadn’t selected a location.

	1. The user selects the “show dossier” command. 2. The user is shown a Query Dialog. 3. The user selects all topics he is interested in. 4. The user confirms his selection. 5. The user is shown a Query Dialog. 6. The user has to select a location via address. 7. The user confirms his selection. 8. The user gets a report for his selected location and topics.
Exception	none
Post-conditions	-
if successful	The user gets a report for his selected location and topics.
if unsuccessful	At step 5 (first case) respectively step 7 (second case) the preparation of the report fails. The user is informed and the use case terminates.
Extensions	Use cases 06, 07

Personalization

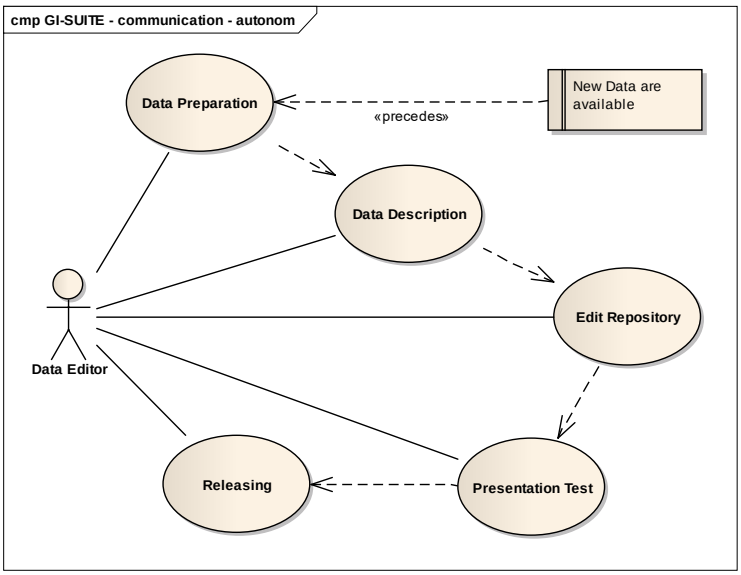
Use Case 11: My topics

Diagram	-
Description	The user wants to manage his saved topics.
Actor	User
Pre-conditions	– The application was started in a browser and works. – The User has access to the internet. – The User is logged.
Trigger	– User wants to save the selected topics.
Sequences of activities	First case: Delete topics 1. The user selects all topics he wants to delete. 2. The user selects the “delete topics” command. 3. The user confirms his selection. 4. The user is shown a Confirmation Dialog (Are you sure?). 5. User replies “YES”. 6. Processing message is displayed to the User. 7. Topics are deleted in the database. 8. Success message is displayed to User. Second case: Add topic 1. The user selects the “add topics” command. 2. The user is shown a list of categories. 3. The user confirms a category. 4. The user is shown a list of topics. 5. The user selects all topics he is interested in. 6. The user confirms his selection. 7. Topics are added to “my topics”. 8. Success message is displayed to user.

Exception	none
Post-conditions	-
if successful	First case: Topics are deleted in the database. Second case: Topics are added to “my topics”.
if unsuccessful	At step 7 (first case) the deleting of the topics in the database fails. The User is informed and the use case terminates. At step 7 (second case) the adding of the topics in the database fails. The User is informed and the use case terminates.
Extensions	Use cases 06, 07

Data maintenance

Use Case 12: Editorial processing of media offer

Diagram	 *Figure 34: Use case diagram 2 - GEOdemos*
Description	– INSPIRE-compliant description of data and services (if possible) – Validation of compliance – Editing and Maintaining of database and user rights
Actor	Data Editor
Pre-conditions	– New data offers must be available as – standards-compliant Services – pre-processed data
Trigger	– Decision of the Project Team.

Sequences of activities	1. Description of the data source 2. Check the data presentation in the test mode 3. Release of the data set for the end user
Exception	none
Post-conditions	-
if successful	New data are available for the description of the location.
if unsuccessful	-
Extensions	-

3.9.2.4 Operating Environment

3.9.2.4.1 Hardware

Due to the solution is a web application, hardware is grouped in client and server.

Clients

The application aims to support both desktop computers and mobile devices, such as mobile phones and tablets. Therefore, it is also designed for running on devices with small screens, touch input and minimal hardware resources. The solution is not limited on specific devices but there are some minimal hardware requirements listed below:

Screen size: minimum 4.3 inches

Processor: 1.0 GHz

Main memory: 768 MB

For testing the application, the following devices will be used:

- Tablets: Apple IPad, Nexus 7
- Mobile phones: HTC M9, IPhone

Server

The hardware requirements of the server depend on the number of users and the frequency of usage, such as number of requests. Based on the fact the number of users will be increase the hardware has to be adjusted gradually. At the beginning the server will have the following setup:

- Processor: Intel(R) Core(TM)i7-3770 CPU @ 3.40GHz 64Bit
- Main memory: 8 GB
- Hard disk: 2 TB

3.9.2.4.2 Software

Client

The application client is system independent. Only a modern browser with HTML5 support and enabled JavaScript is needed to run the application. The following browsers will be tested during the development:

- Chrome version >= 48.0
- Firefox version >= 44.0
- Microsoft Internet Explorer11and Edge
- Safari version >= 9

Server

Because the web application is based on Java technology it is independent from operating system. The server uses the following software:

Operating system:

- Windows Server 2008

Runtime environment:

- Name: JRE >= 8

Servlet container:

- Name: Apache Tomcat >= 8

GDI software:

- GIS-BROKER version >= 6

RDBMS

- Oracle >= 9

3.9.2.5 User Documentation

Administrator:

- Administration manual

User:

- User manual (PDF)
- Tooltips

Editor:

- Online help
- User manual (PDF)
- Tooltips

3.9.2.6 Assumptions

Data

- The data will provide by geoportals in the formats und structures as defined by INSPIRE e.g. spatial reference data such as administrative units of European countries and it's possible to use Reference data services of the EU Project E.L.F.

Social Framework

- In the course of Europeanization of the economy, the mobility of people will grow and the demand according to comparable information from all over Europe to support the choice of residence will increase.
- Further extensions of the application will give users the ability to fill their own information and reviews into the system and thus strengthen the significance of the location information

Networking of HUB and Applications

- In the planning and application phase of the project we assumed that our HUB is part of a HUB network, whose notes sit on various technologies and communicate via defined and standardized interfaces at the same hierarchical level.
  Based on these standards and interfaces, the VH architecture would have been open to the participation of any software solutions which join the HUB network after end of the

project. Various HUB could work collaborative and provide various services. Other applications could use value-added services of SRP HUB via these interfaces.

3.9.2.7 Constraints

Data

- The services of the project E.L.F will not be available before 2017.
- Also the countries are only from 2017 obliged to provide their data in a structure INSPIRE-compliant. Fact is these data will not provide by geoportals in the defined formats und structures at present.
- We cannot get much data and services in the needed structure during the duration of the project such as comparable reference areas, corresponding geographical and alphanumeric data, usable metadata and vector data via. This means among other things that we cannot integrate the data services directly into the application. Instead we have to prepare the data with our programs.
- Nevertheless, we pursue the objective to prepare our interfaces to these standards. To test the functionality of our solutions, we would prepare selected data accordingly:
    - The data from Geo and Open Data portals, which are not defined by INSPIRE are prepared, described and made available via standardized services. Within the frame of the budget can also be prepared and provided only selected data sets. The preparation methods will be described and can later be used by other project participants or project partners in order to expand the dataset on the basis of an appropriate business model.
    - The quality of the content of the provided data cannot be tested and improved as part of the project budget. Therefore, SRP accepts no responsibility for the information obtained by the user.

Networking of HUB and Applications

- Currently a hierarchical architecture is planned and it is still unclear in this project phase how the individual applications access the distributed data and services within the hierarchical architecture.

  The currently planned technology has definitely a non-hierarchical approach. Building a hierarchical hub structure requires additional organizational models that need to be worked out in WP 8. Such a model can consist in the long term only within the framework of complex contracts. As experience shows such contracts are economically unviable in the long run.

Hardware and software limitations

- The application has to be web based (no app programming for every platform)
- The client application should only need a browser for working
- Support only for modern browsers (HTML5-Support)
- JavaScript-Support is mandatory

3.9.3 External Interface Requirements

3.9.3.1 User Interfaces

The user interface of the application has to be intuitive operable. No special skills are needed for using it.

Outputs:

- Responsive Design (application runs on phone, tablets and desktops)
- Visualization of geodata in a map
- Presentation of results in scrollable lists
- Highlighting objects in the map

Inputs:

- Touch-Screen support
- Keyboard support
- Mouse support

Map navigation:

- Pinch zoom
- Panning
- Touch selection

3.9.3.2 Hardware Interfaces

The application does not directly use hardware interfaces.

3.9.3.3 Software Interfaces

The application will use an interface, called BAI, to communicate with software GIS-BROKER. The communication is based on HTTP and provides to following functionality:

Get catalogue:

- HTTP GET/Post Request
- HTTP XML response

Get metadata:

- HTTP GET/Post Request
- HTTP XML/JSON response

Get data:

- HTTP GET/Post Request
- HTTP XML/JSON response

Search address:

- HTTP GET/Post Request
- HTTP XML response

3.9.3.4 Virtual Hubs and Data Sources

The component “V-Hub-API-Client” of the solution uses the JS API (GI API) provided by the VHub to search and discover Open Data brokered by the VHub. The current version of GI API is 1.3.3 beta.

The “Mapping component” and the “Geodata server” have clients to access WMS and WFS-data sources. The following versions are supported:

Web Map Service (WMS) 1.1.1, 1.3.0

Web Feature Service (WFS) 1.0.0, 1.1.0, 2.0.0

The component “Personalization (Server)” has an interface to connect to an authentication service. Perhaps this service could be provided by the VHub.

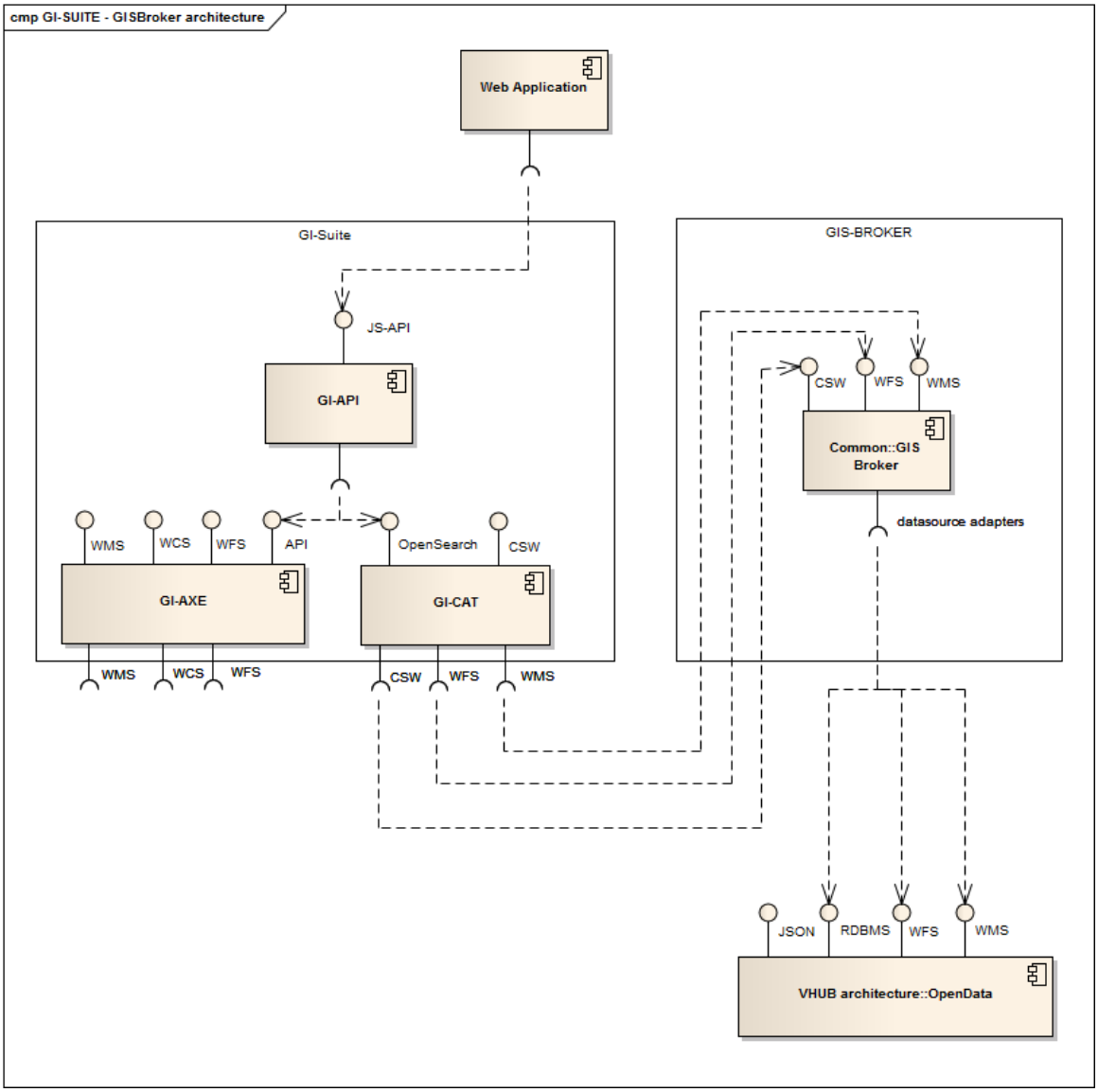


Figure 35: GEOdemos VH and data source interfaces

3.9.3.5Communication Interfaces

The application GEO*demos* will use protocol HTTP for communication between internal client and server components and between application and external systems like the VHubs. It will be prepared for using HTTPS as well.

JDBC will be used by the GEO*demos* Server for accessing relational database systems to store user profiles and processed data.

3.9.4 Functional Requirements

ID	F01A9
Requirement	Platform independence and installable in various system environments
Priority	High
Use case Reference	use case 01
Description	- The front end is a browser application. It uses the specific functions of the mobile browser versions. The compatibility of the mobile browser is still very different. But improvements are discernible.

ID	F02A9
Requirement	Configurable for various target groups and use cases
Priority	High
Use case Reference	use case 01
Description	- The first feedbacks by the user will show whether all requirements can be satisfied with a single user interface, or whether application-specific interfaces have to be provided. Software side, this presents no problem. The consequences regarding the business model have to be tested.

ID	F03A9
Requirement	spatial and content-related search
Priority	High
Use case Reference	use cases 05, 06, 07
Description	- define search criteria to explore the local quality of live - select ready to use search profiles for a targeted search (predefined set of search criteria)

ID	F04A9
Requirement	modification of the evaluation methods
Priority	High
Description	- prioritization of search criteria - define personal priorities

ID	F05A9
Requirement	cartographic representation of the evaluation results
Priority	High
Use case Reference	use case 08, 09, 10
Description	– visualize the results of the search in a map (locations providing quality of living) – visualize the results of the search in a report – Visualization of spatial and attribute data

ID	F06A9
Requirement	export / share reports
Priority	High
Description	– PDF Export

ID	F07A9
Requirement	Personalization
Priority	High
Use case Reference	use case 11
Description	– storage of personal settings

3.9.5 Non-Functional Requirements

ID	N01A9
Requirement	Performance
Priority	High
Description	– using Load Balancing for intercepting peak loads

ID	N02A9
Requirement	Usability
Priority	High
Description	- multi-language support - responsive (working on mobile phones, tablets, notebooks and desktops) - user only needs basic knowledge in EDP

ID	N03A9
Requirement	Reliability
Priority	High
Description	– availability of the application and the services – fail safety of the Server – accuracy of the information

ID	N04A9
Requirement	Security
Priority	High
Description	– HTTPS-support – protect user / costumer data

ID	N05A9
Requirement	Portability
Priority	High
Description	– Cross/Multi-platform – mobile support

ID	N06A9
Requirement	Maintainability
Priority	High
Description	– provide test automation

ID	N07A9
Requirement	Scalability
Priority	High
Description	– The components of the GIS-BROKER frameworks can be distributed and multiplied in the network. – Several BROKER instances can work together in the network

3.9.6 Data Requirements

ID	D01A9
Requirement	Availability
Priority	High
Use Case Reference	all use cases
Description	– They should be free of charge. – The license conditions must allow that the data can be – copied, printed, presented, changed, edited, and passed on to third parties. – merged with its own data and data of other parties. – combined in new services. – integrated into internal and external business processes, products and applications in public and private electronic networks.

ID	D02A9
Requirement	Accuracy
Priority	High
Use Case Reference	all use cases
Description	– Accuracy means the reliability of Information. The accuracy of the data content cannot be checked by the app provider. He can only check logical Accuracy, such as the uniqueness of identifiers. The key, however, is the seriousness of the data provider's. Consequently, only data of public providers are used.

ID	D03A9
Requirement	Granularity
Priority	High
Use Case Reference	all use cases
Description	– The spatial granularity is critical to the usefulness of the information. While the basic data for some European countries are at a relatively high resolution available, the thematic data are usually aggregated. In particular, the social data (population structure, migration, income ...) are highly aggregated because of data protection. It is necessary to examine how this lack can be compensated by the combination of interdisciplinary data.

ID	D04A9
Requirement	Interfaces
Priority	High
Use Case Reference	all use cases
Description	– Data should be provided by a standardized service.

ID	D05A9
Requirement	Up to date
Priority	High
Use Case Reference	all use cases
Description	– INSPIRE-compliant metadata contains information about the up-to-dateness of data (creation date, update date, expiration date). Unfortunately, only one of this information is mandatory and data providers fill this parameter very different. Although this information can be passed on to the users, but the originally planned comparison of equal time

	intervals cannot be realized.

ID	D06A9
Requirement	Comprehensibility
Priority	High
Use Case Reference	all use cases
Description	– The user must be able to understand the information content of the data. To ensure this, appropriate legends must be made available especially in thematic maps. At any time, the associated metadata must be presented.

ID	D07A9
Requirement	Structure
Priority	High
Use Case Reference	all use cases
Description	– Starting from the year 2017 INSPIRE data are provided in a unitary structure. Until then the necessary data must be pre-processed. Nevertheless, the processing methods will be prepared on INSPIRE-compliant structures.

3.10 Sensor Open Data Portal (by ALKANTE)

3.10.1 Introduction

With the emergence of data generated in the field of Internet of Thing through a variety of sensors, there is a need for generic tools to collect sensor data and innovative ways to visualize it. The Sensor Open Data Portal (Sensor ODP) tends to address parts of this problem. More precisely, the Sensor ODP will collect sensor data, provide a standardized interface to access them and will offer a web application to visualize sensor data together with other geographical data.

The sensor ODP will provide an entry point to sensor data (such as environmental data, temperature, wind information...). The data are real time generated data that may be logged on the sensors or transmitted in almost real time through web services. The sensor ODP may collect data directly from sensors or from a sensor gateway using standardized web services (such as OGC SOS), however if sensors do not provide these functionalities, the sensor ODP may be equipped with ad'hoc bridges to communicate with the sensors or their gateway. The sensor ODP will deliver data in a standardized way by relying on OGC standards (SWE, SOS). In fact, the application will act as a generic sensor data connector.

The sensor ODP will provide 4 main functions:

- *collect and store*: the sensor ODP will collect and store data from a predefined set of environmental sensors. Newest data but also past data will be available.
- *share using standards*: the collected data will be available as an output of sensor ODP through OGC standards: SOS, WFS and WMS
- *visualize*: the sensor ODP includes a web application that allows users to query and

visualize sensor data through a web page.

- *visualize together*: the web application will allow to visualize the sensor data together with other geographical data coming from ENERGIC OD VH. The web application will be able to query the VH for particular data in a particular format (e.g. OGC WMS) and display it together with the sensor data.

An overview of the system is given in figure 36.

The field of application is centered on environmental data and smart city data. Several sensor networks exist and are already deployed to provide environmental measures. The sensor data access is related to the INSPIRE directive.

One main benefit of Sensor ODP is to increase the exploitation opportunities for open GI by bringing to specialists and citizens open environmental data automatically collected from sensors that do not provide natively standardized access to their data.

3.10.2 General Description

3.10.2.1 Product Perspective

The sensor ODP will be a new solution that will be built upon existing software components (geomatic open source off-the-shelf components and Alkante existing software components). The solution will interact with the French VH (and potentially other VH) to provide collected sensor data in common Open Data formats.

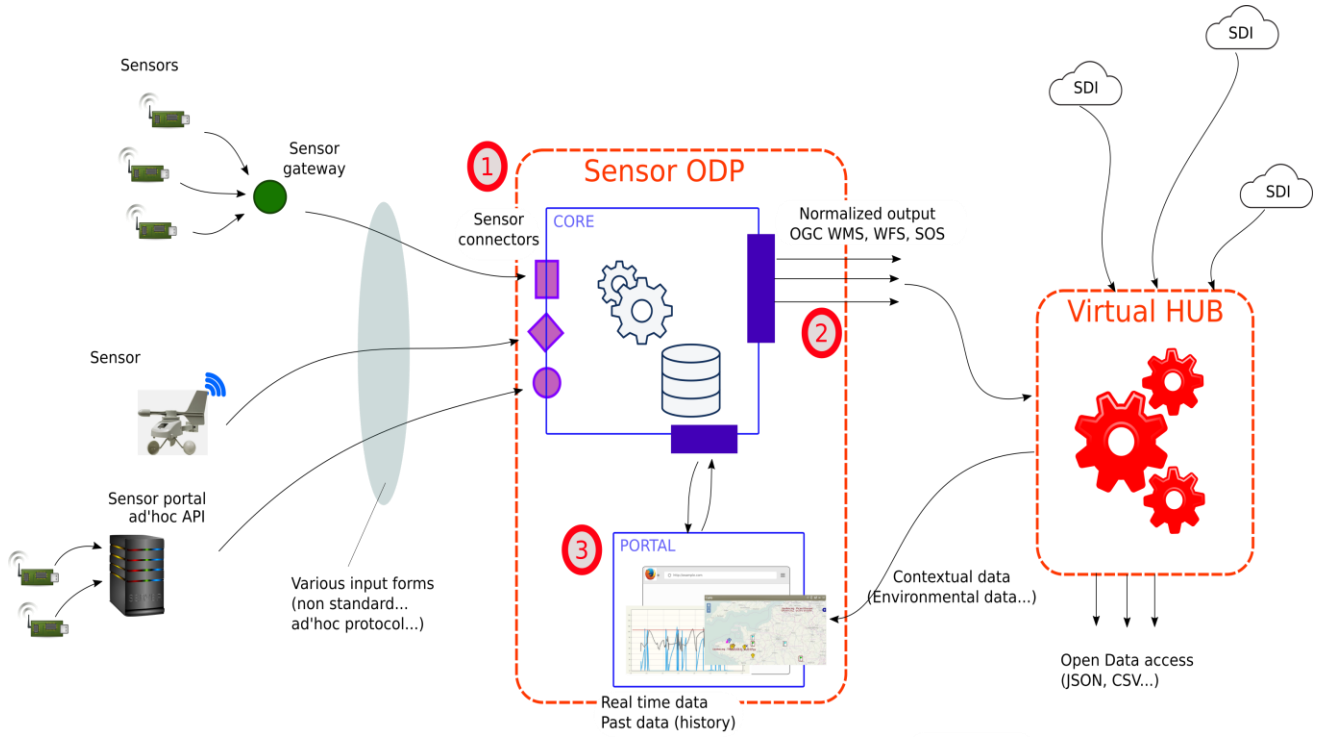


Figure 36: Sensor ODP system overview

3.10.2.2 Product Functions

The main functionalities of the solution can be considered in terms of inputs/outputs:

Function collect and store

Inputs are sensor data collected from sensors or from sensor gateway. It is the responsibility of the sensor ODP application to connect the sensor or its gateway with the right protocol. Collected data are stored in the application database. There is no output for this function.

Function share using standards

There are no particular inputs for this function as data are taken from the sensor ODP database. Data will be available as output of the application through the following OGC web service: SOS 2.0, WMS 1.3 and WFS 1.1.1 The data will be provided at least in Lat/lon projection (WGS84, EPSG:4326). The VH should be able to query data in one of these standards

Function visualize

Inputs come from the sensor ODP database. The sensor data collected can be visualized in a web page composed of different view of the data (map, diagram, tables...). The web page also includes a query box enabling the user to specify the kind of data he wants to query and the date or the period he is interested in. Actually, the output is web interface.

Function visualize together

Inputs come from the sensor ODP database and can be visualize together with data coming from the VH. The sensor ODP web application expects the VH to deliver data in WFS 1.1 or 2.0 and in WMS 1.3 in projection webMercator (EPSG:3857).

3.10.2.3 User Characteristics

In the following we consider different categories or classes of users based on their preferred interface to interact with the solution, e.g. “open data user” category gathers people accessing the delivered in open data standards through the VH whereas the “geomatic user” category deals with people used to consume data through OGC web services.

3.10.2.3.1 User Classes

A user class can designate a group of people as well as a legal person (e.g. a local authority). Furthermore, our user classes are designed so that it may happened that a particular user belongs to different classes.

Five user classes are considered:

- **Sensor Data Providers** provide sensor data that are collected and stored by the sensor ODP. This class contains for instance:
  - local authorities owning a sensor network or producing sensor data
  - sensor resellers willing to enrich their devices with a “data as a service” solution...
- **Open Data Consumers** access sensor data in open data formats through the VH. This class gathers people from the opendata community like:
  - citizens
  - application developers...
- **Web Portal Users** visualize sensor open data through the Sensor ODP web portal. This class contains various people like:
  - citizens

- geomatic users
- thematic experts...

- **Web Portal Registered Users** visualize open as well as private sensor data through the Sensor ODP web portal. This class mainly designates:
  - sensor data owners (local authorities...)
  - user granted by sensor data owners (thematic experts...)

- **Geomatic Expert** accesses the sensor data through the standardized outputs of the solution. This contains people like:
  - G.I. experts
  - GIS specialists from local authorities...

3.10.2.3.2 Relation of Users and System Components

The **Sensor Data Providers** provide sensor data as inputs in the solution.

People from the **Open Data Community** consume data that are delivered by the solution and transformed by the VH.

In the same way, **Geomatic Experts** consume the same kind of data but directly through the standardized output of the solution.

Web Portal Users (Register and Unregistered) access the sensor data through the web portal of the solution.

3.10.2.3.3 Use Cases

3.10.2.3.3.1 Push Data in Sensor ODP (UC1)

Diagram:

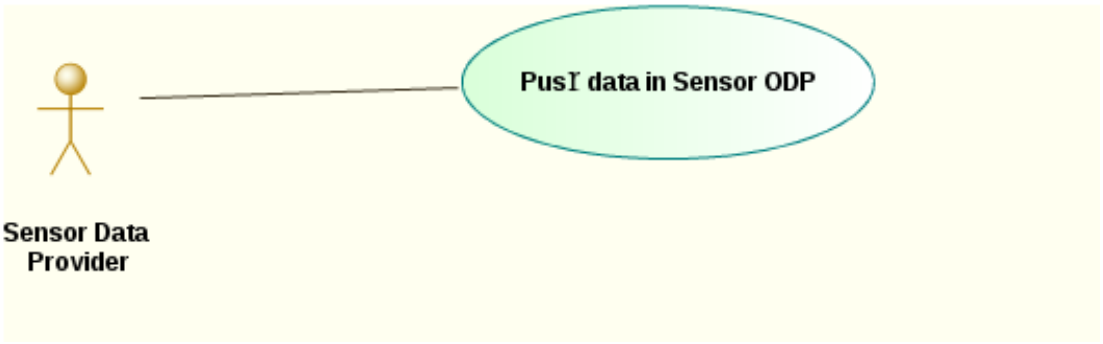


Figure 37: Use case diagram 1 - Sensor ODP

Description:

Sensor data providers push their sensor data in the Sensor ODP solution using their preferred connectors.

Pre-conditions:

The sensors communicating have to be registered in the Sensor ODP database.

Post-conditions:

None

Extensions:

None

3.10.2.3.3.2 Query the VH for sensor data sources (UC2)

Diagram:

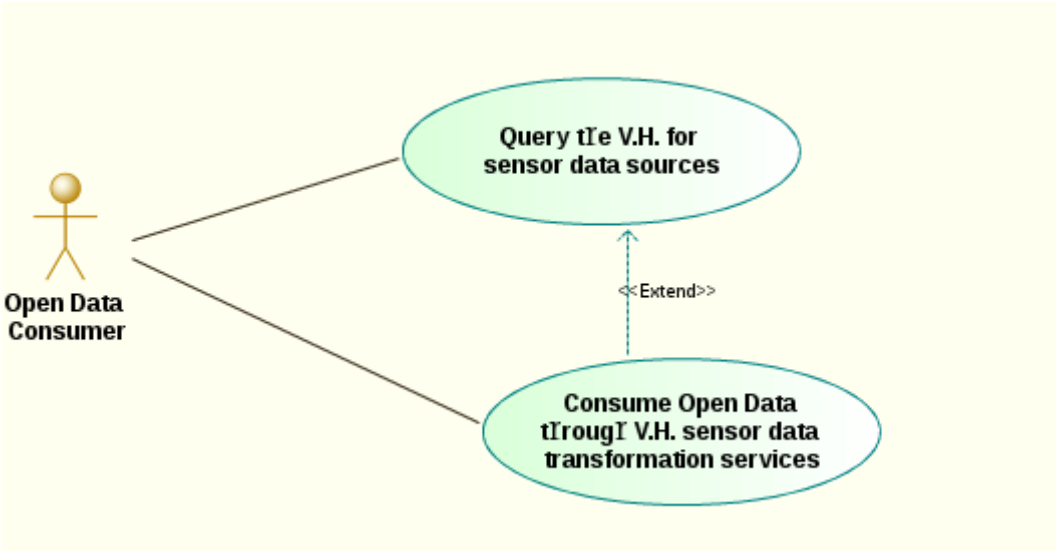


Figure 38: Use case diagram 2 - Sensor ODP

Description:

Open data consumers query the VH search engine for sensor data

Pre-conditions:

None

Post-conditions:

None

Extensions:

None

3.10.2.3.3.3 Consume Open Data through VH data transformation services (UC3)

Diagram:

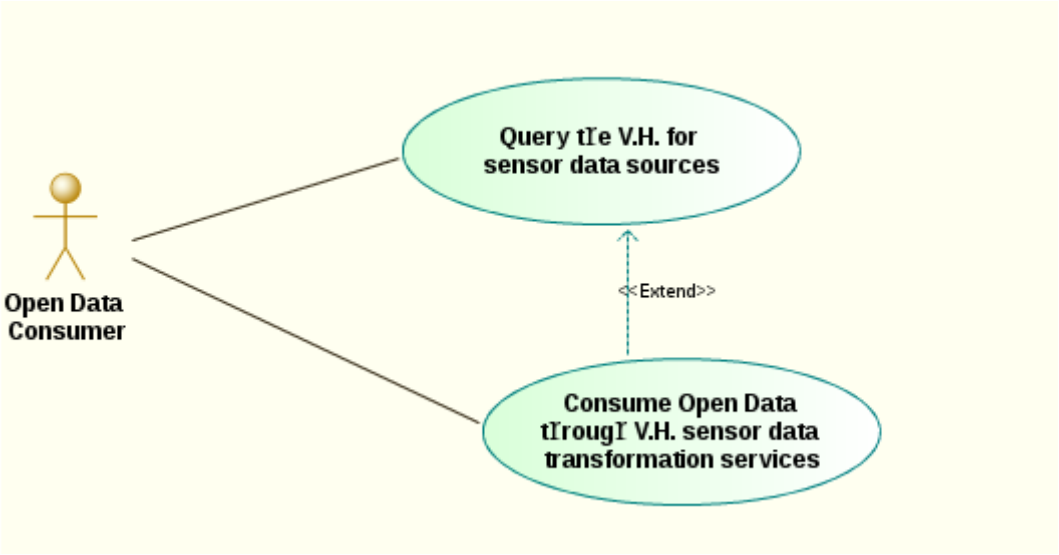


Figure 39: Use case diagram 3 - Sensor ODP

Description:

Open data consumers get sensor data in their open data format (CSV, JSON, GeoJSON...)

Pre-conditions:

The targeted sensor data source is accessible from the VH.

Post-conditions:

None

Extensions:

UC2

3.10.2.3.3.4 Consume sensor Data using OGC standards (UC4)

Diagram:

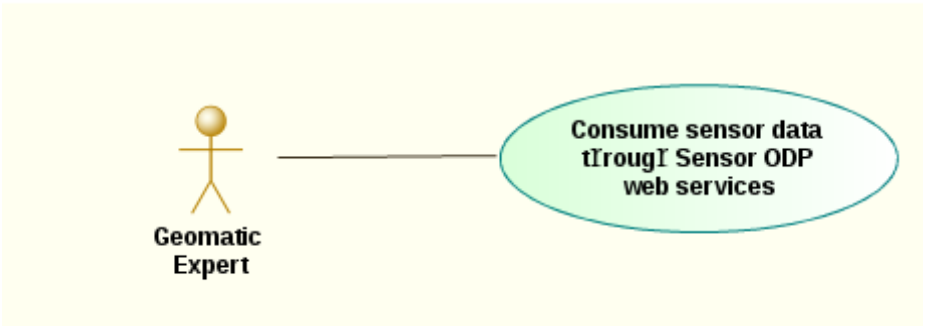


Figure 40: Use case diagram 4 - Sensor ODP

Description:

A geomatic expert queries the web services of the solution (WFS, SOS) to get back sensor data.

Pre-conditions:

The targeted sensor data source endpoint is known by the user

Post-conditions:

None

Extensions:

None

3.10.2.3.3.5 Navigate in the map of the web portal (UC5)

Diagram:

Web Portal User uses map navigation tools (pan, zoom, address locator...) to move on the map and find visually sensor locations appearing as icons on the map.

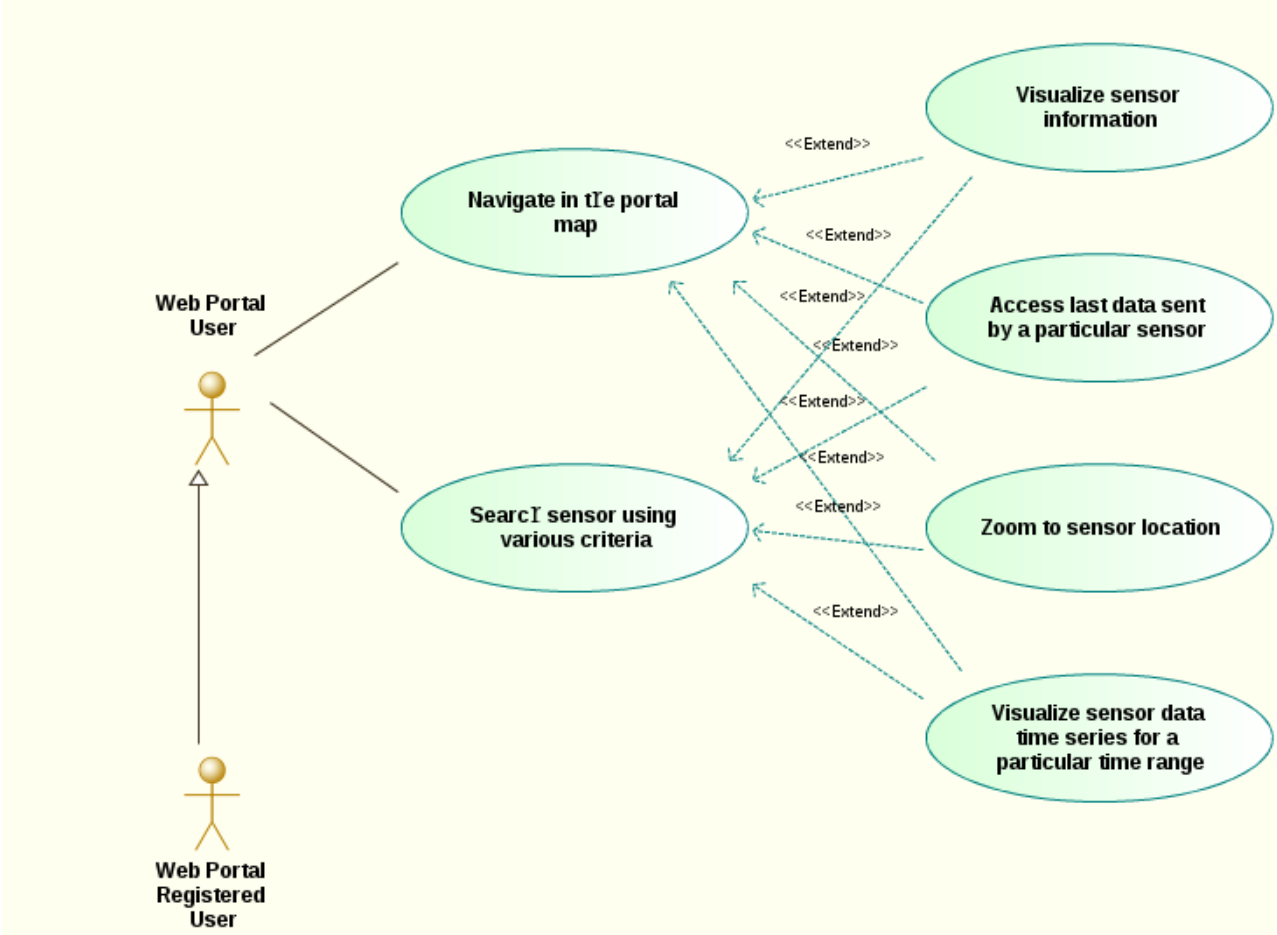


Figure 41: Use case diagram 5 - Sensor ODP

Pre-conditions:

None

Post-conditions:

None

Extensions:

None

3.10.2.3.3.6 Navigate in the map of the web portal (UC6)

Diagram:

see UC5

Description:

Web Portal User uses the web portal search engine to find a set of sensors using various criteria (thematic, network or sensor fleet membership...)

Pre-conditions:

None

Post-conditions:

None

Extensions:

None

3.10.2.3.3.7 Visualize sensor information (UC7)

Diagram:

see UC5

Description:

Web Portal User access information (name, id, model, precise location, quantity measured...about a particular sensor by acting on its icon on the map or in its descriptive row the list of current selection of sensors.

Pre-conditions:

Sensors are selected in the portal, i.e. they appear in the list of selected sensors and they are located on the map.

Post-conditions:

None

Extensions:

UC5, UC6

3.10.2.3.3.8 Access the last data sent by a sensor (UC8)

Diagram:

see UC5

Description:

Web Portal User visualize the last measures transmitted by a senor in a table in a chart by acting on its icon on the map or in its descriptive row the list of current selection of sensors.

Pre-conditions:

Sensors are selected in the portal, i.e. they appear in the list of selected sensors and they are located on the map.

Post-conditions:

None

Extensions:

UC5, UC6

3.10.2.3.3.9 Zoom to sensor location (UC9)

Diagram:

see UC5

Description:

the map is re-centered on a particular sensor location or on the extent enclosing a set of sensors by acting on the list of the current sensor selection.

Pre-conditions:

Sensors are selected in the portal, i.e. they appear in the list of selected sensors and they

are located on the map.

Post-conditions:

None

Extensions:

UC6

3.10.2.3.3.10 Visualize a sensor data time series (UC10)

Diagram:

see UC5

Description:

Web Portal User visualizes a range of data measure by a particular sensor in a chart or in a table by acting on its icon on the map or in its descriptive row the list of current selection of sensors.

Pre-conditions:

Sensors are selected in the portal, i.e. they appear in the list of selected sensors and they are located on the map.

Post-conditions:

None

Extensions:

UC5, UC6

3.10.2.4 Operating Environment

The different components of the Sensor ODP solution can be described using a layered approach which can be seen in figure 42. The different layers will be referenced later in the document to illustrate the hardware and the software environments that have been adopted.

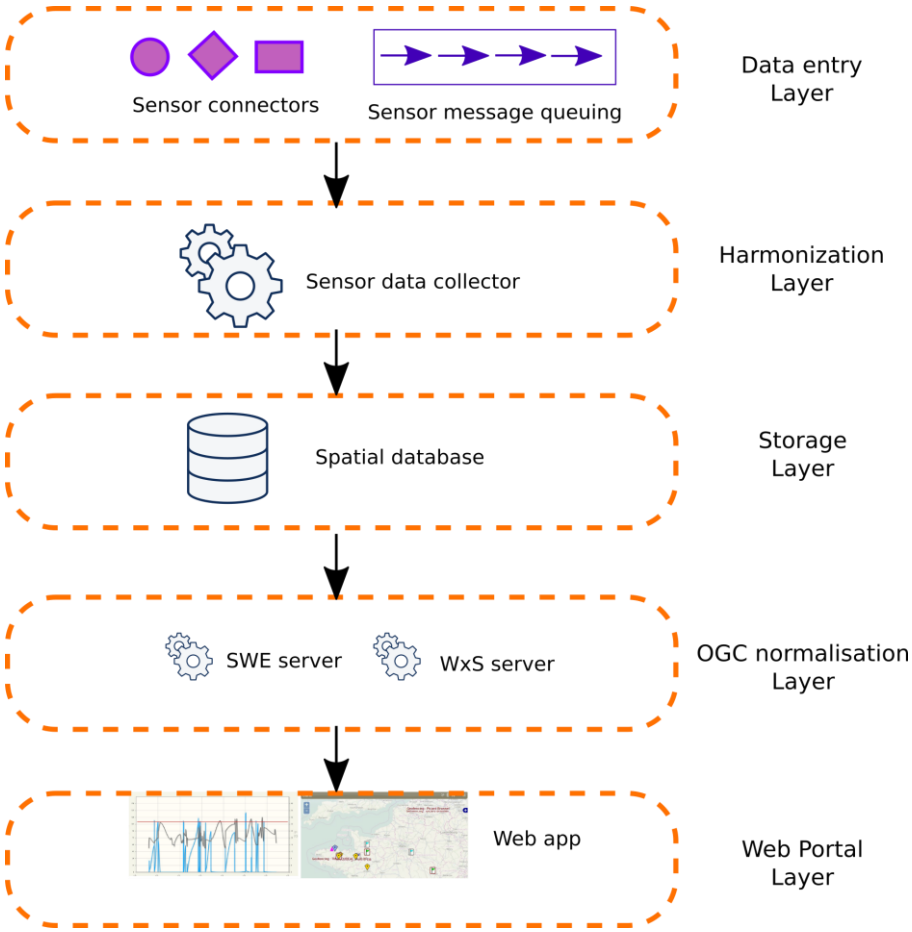


Figure 42: Layered approach of the Sensor ODP architecture

3.10.2.4.1 Hardware

The Sensor ODP solution can be deployed in two different hardware architectures:

- a deployment on a single server, grouping together all the component and the interfaces of the solution
- a multi-server architecture, enabling the isolation of some layers of the solution:
  - a dedicated server for the storage Layer
  - a dedicated server for the data entry Layer/Harmonization Layer
  - a dedicated server for the normalization Layer
  - a dedicated server operating as the Front End and hosting the Web Portal Layer and the interface for accessing the normalized sensor data output (OGC Web Services)

The solution is to be deployed on one physical server considering one or more logic servers (relying on virtualization approach). Each server is running a standard Linux Debian OS distribution (Last Long Time Support version).

The server will be hosted by the partner Alkante.

3.10.2.4.2 Software

The Sensor ODP will be built on top of several well adopted open source components for

geomatics which form an open source stack for geomatics. More precisely, these components are: OpenLayers, Mapserver, GDAL/OGR, 52North SOS Server, PostgreSQL/PostGIS.

The web server part will use common web components such as Apache, Tomcat, RabbitMQ.
The web application part will mainly be written in Javascript and PHP and will rely on HTML 5 features.

Figure 43 shows how the different software components are attached with the layers of the system.

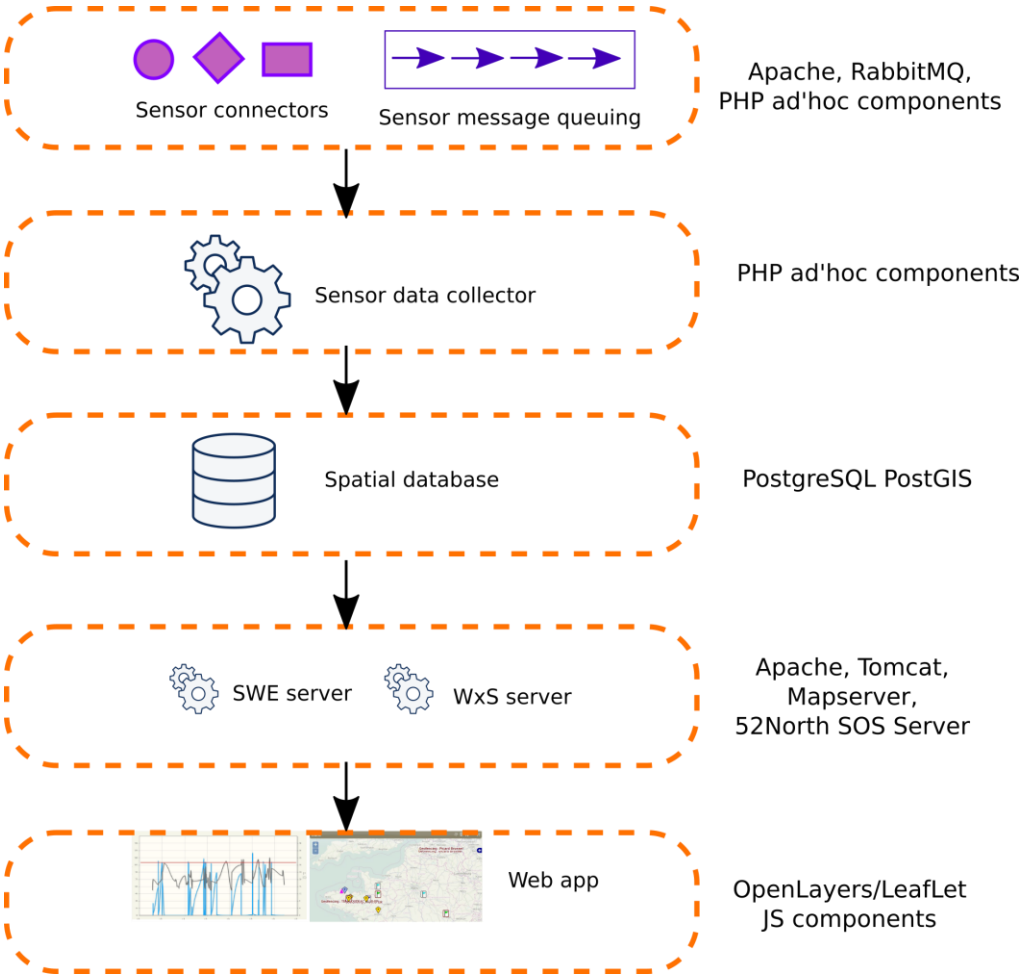


Figure 43: Layered approach of the Sensor ODP architecture

The version of the main software components that are foreseen are listed in the following table.

Component	Version	Comments
Mapserver	7.0	WebMapping, WMS/WFS Component
Postgres/Postgis	9.4/2.1	Storage Layer
52 North SOS Server	4.3	SWE component

Tomcat	7	
PHP	5.4	Ad'hoc connectors
OpenLayers	3.x	
RabbitMQ	3.5	Sensor data queuing
GDAL/OGR	1.0	Data transformation

Table 4: Software components of Sensor ODP

3.10.2.5 User Documentation

Different kinds of documentation will be associated with the solution.

Sensor data provider could access sensor data connector specification document (in pdf formats) to get the technical information required for them to push their data in the solution.

Concerning **web portal users**, the functionalities of the web portal will be described in a user manual (in pdf formats). Furthermore, tooltips will assist the user contextually when navigating on the portal.

Open data consumer could consult the VH documentation.

The endpoints (URL) of the sensor data web services of the solution will be advertised on different supports (Sensor ODP web portal page, ENOD project webpage, metadata associated with the sensor data and with the services...). These endpoints are necessary for the **geomatic experts** to consume the sensor data.

3.10.2.6 Assumptions

Data availability

The sensor ODP plays the role of a sensor data connector and visualizer. So the application relies on the availability of sensor data and, in the context of the ENERGIC OD project, on the availability of these data as Open Data.

The development of the sensor ODP application also relies on the assumption that sensor data may be accessible directly from the sensor of from a sensor gateway. Data are generally available through web services that may be standardized (OGC SOS, OGC SOS-T) or not. In the case of non-standardized access, the sensor ODP application will be equipped with ad'hoc bridges to connect the sensors or their gateway.

The partner ALKANTE is currently strengthening its collaboration with sensor data providers to fuel the application with data. The task of finding new data sources will be conducted during the whole duration of the ENERGIC OD project.

VH data transformation capability

The sensor ODP solution is intended to be tested with the French deployment of the VH. More precisely, the solution will rely on some specific services of the VH to make its outputs available in Open Data format:

1. the SOS connector for GeoJSON/JSON/CSV export (A)
2. the WFS/GML into GeoJSON conversion service (B)

The partner Alkante will certainly take part in the development of this functionality of the French VH.

End User capability to consume sensor data

It is assumed that the End Users interested in working with the sensor data delivered by the solution have the technological capability to consume the data in at least one of the output formats provided directly by the application (OGC Web service WFS, WMS or SOS) or through the VH transformation interfaces (CSV, JSON, GeoJSON).

3.10.2.7 Constraints

Availability, Quality of data

The sensor ODP does not directly produce data, it collects and delivers data from existing sensors so the availability as the quality of the data delivered are related to the smooth functioning of sensors. Data availability may be disturbed by network failure and data quality may be altered by sensor malfunctions.

Software limitation: database size

Sensors may generate a significant quantity of data. Storing and keeping past data will entails a continuously increase of the size of the sensor ODP database. To not have to maintain large datasets in the context of a pilot application for the ENERGIC OD project, the sensor ODP could provide only data for a moving predefined period, for instance the temperature values collected by a network of sensors for the last 6 months.

Evolution of standards

Standards use to communicate with sensors or the VH may evolve. The application will rely on the most recent versions of the standards at the time of the beginning of the application development. Concerning the communication with the VH, we could reasonably assume that the VH can make the translation between the version of standards use in the application and the latest versions of the standards.

3.10.3 External Interface Requirements

3.10.3.1 User Interfaces

Concerning the **sensor data providers**, an acknowledgement mechanism may be set to confirm that the sensor data transmitted by the provider has correctly been consumed by the solution. This cab depends on the technology used for data transmission.

For the **Open Data Consumers**, the user interface is the one of the VH.

For **geomatic experts** accessing the standardized web services, the user interactions will follow the underlying web service mechanisms, e.g. for error notifications.

Dealing with the **web portal users**, the web portal graphical user interface will be developed

conforming to good practices in web application design (including general principles of User eXperience). Furthermore, the map view will include traditional map navigation tools (zoom, pan, locate) with a layout similar to what can be seen in national and regional map portal.

3.10.3.2 Hardware Interfaces

Concerning the hardware interfaces, the hardware communication is managed by the libraries and the software components used by the solution, e.g. the queuing component, the database server.

3.10.3.3 Software Interfaces

The solution is not intended to communicate with external software components except with the VH and other external data sources. This particular point is described in the next section.

3.10.3.4 Virtual Hubs and Data Sources

Virtual Hub

The communication between Sensor ODP and the VH will exclusively relies on the OGC web services that are delivered as output of sensor ODP. The OGC (WMS, WFS, SOS) web services will be consumed by the VH.

External Data sources

The sensor ODP Solution will include tiles coming from external tile services (OSM tile layer queried using standard tile protocols).

Furthermore, the sensor data itself will come from external devices (sensors or sensor gateway). The protocol used to collect the sensor data varies with the nature of the sensors and the architecture of the underlying sensor network. It can be API based, relying on ad'hoc web services, or IP socket communication for instance.

3.10.3.5 Communication Interfaces

Communications between Sensor ODP and the VH will rely on OGC web services over HTTP. The communication with external tile service will also rely on HTTP.

Concerning the collection of sensor data, various interfaces may be used. Existing ones includes: FTP, HTTP Rest, HTTP SOAP, IP Socket. Some channels may be secured at the protocol level if required (SFTP, HTTPS...). The format of the message delivered by the sensors is not driven by the Sensor ODP, as the aim of the solution is actually to be compatible with a variety of heterogeneous existing sensors. The only strong requirement is that the identifier of the sensor and the time of each measure is explicitly advertised or can be deduced with no ambiguity.

3.10.4 Functional Requirements

ID	F01A10
Requirement	Exchange of data
Priority	High
Use Case Reference	UC2, UC3, UC4
Description	Sensor ODP should be able to output sensor data as OGC

	standard web services so that they can be consumed by the Geomatic community or by the VH to address the Open Data community.

ID	F02A10
Requirement	Processing of data: Collection, storage, data transformation...
Priority	High
Use Case Reference	UC1
Description	Sensor ODP needs storage and computing capabilities to decode sensor messages and store them in a database.

ID	F03A10
Requirement	Map navigation: panning, zooming, address geocoding...
Priority	Medium
Use Case Reference	UC5, UC9
Description	Sensor ODP web portal includes a map view to locate the sensor on a map and query them.

ID	F04A10
Requirement	Data visualization: table, charts...
Priority	Medium
Use Case Reference	UC5, UC6, UC7, UC8, UC9, UC10
Description	Sensor ODP web portal needs graphical components to represent sensor information and sensor measures in an attractive and comprehensive way.

3.10.5 Non-Functional Requirements

ID	N01A10
Requirement	Portability: Maintenance and minimum redesign for data entry layer
Priority	Medium
Description	The connection of new sensors coming from a new sensor provider using a particular protocol or with particular data definition should not entails the redesign of the application. The application architecture should be flexible enough to allow new sensor data definition or new sensor communication protocol by the addition of specific plugins, the customization of an existing one or adjusting settings of the application.

ID	N02A10
Requirement	Performance
Priority	High

Description	The system should be able to provide access to sensor data in a reasonable time whether it is through the sensor ODP web application or through the sensor ODP web services. For instance, third-party application using sensor ODP web services should not raise time-outs when asking for a reasonable quantity of data.

ID	N03A10
Requirement	Scalability
Priority	Medium
Description	The sensor ODP architecture should be designed to allow a growing number of data collected or sensors harvested. Even if such amount of data is not raised during the ENERGIC OD project, it is relevant for the viability of the application that it is compatible with scalable approach such as database clustering.

3.10.6 Data Requirements

The data requirements are listed below:

ID	D01A10
Requirement	Sensor data availability
Priority	High
Use Case Reference	UC1
Description	Sensor ODP is developed to handle sensor data. Sensor data is the main input of the solution.

ID	D02A10
Requirement	Sensor location availability
Priority	Medium
Use Case Reference	UC5, UC9
Description	For sensors that do not communicate their location, a sensor location layer is required to place them on the map.

ID	D03A10
Requirement	Base Map coverage
Priority	Medium
Use Case Reference	UC5, UC9
Description	A base map helps the map navigation to locate the sensor.

ID	D04A10
Requirement	Location service availability
Priority	Low

Use Case Reference	UC5
Description	A locate by address tool will help map navigation.

ID	D05A10
Requirement	Use of OGC standards for data exchange
Priority	High
Use Case Reference	UC3
Description	The consumption of sensor data directly at the output of the solution will required to use OGC standards

4 AGGREGATION OF REQUIREMENTS

4.1 Functional Requirements

The functional requirements are principally related to the individual application features, which derived from the specific application use cases. However, as all applications include geodata and as most of them will provide a geoportal with common map features, there are some well summarized functional requirements besides a lot of application specific functional requirements.

ID	Requirement	Description
F01	Editing	Map-side digitizing of geometries
F02	Editing	Input of georeferenced text
F03	Exchange of data	The solutions enable upload of images by users.
F04	Exchange of data	The solutions enable the export of data as: • ASCII text file • PDF
F05	Exchange of data	The solutions provide OGC web services: • WMS • WFS • WPS • SOS • CSW
F06	Exchange of data	The solution is able to request and receive data from external systems. Geodata will be requested from: • WMS • WFS • WPS • WCS

		• WMTS • SOS • SOS-T • CSW
F07	Monitoring	Request and response of data will be monitored and evaluated.
F08	Navigation	Panning and zooming of maps
F09	Navigation	The solutions enable the selection of map layer.
F10	Processing of data	Data will be collected, stored and provided.
F11	Processing of data	The solutions enable the transformation from heterogeneous data to comparable homogeneous data.
F12	Query	Request information from map-side visualized objects and attribute search.
F13	Selection of data	The solutions enable selection of data by: • Date • Address • Spatial features
F14	Selection of data	The solutions enable output of data by user defined criteria.
F15	User access	Users can log-in and use personalized data.
F16	User access	The solutions are able to automatically generate user accounts enabling log in of users.
F17	User access	The solution enables the creation of user specific sessions.
F18	User access	The solution sent authentication e-mails to a user.
F19	Visualization	Visualization of georeferenced text in map
F20	Visualization	The solutions will visualize spatial data as: • 2D map • 3D landscape scene
F21	Visualization	The solution will visualize attribute data, geodata and metadata as: • Table and Chart

Table 5: Aggregation of functional application requirements

4.2 Non-Functional Requirements

The non-functional requirements are less application specific and more general for all applications.

ID	Requirement	Description
N01	Accessibility	Different kinds of access rights will be enabled for users to use data and functions.
N02	Accuracy	The solutions provide visualization of data and results of data

		analysis of a high quality.
N03	Availability	Reliable and almost permanent reachable solutions should be fulfilled.
N04	Interoperability	The solutions enable the exchange of data between different systems.
N05	Maintenance	The solutions require no or minimal redesign in case of new data, data sources, changed standards, interfaces or protocols.
N06	Performance	The solutions are able to process and analyse date almost in real-time.
N07	Performance	The solutions are able to intercept peak loads.
N08	Portability	The solutions are able to process large as well as small amount of data.
N09	Scalability	The solutions will serve an amount of users in the range between less than ten and several hundred.
N10	Scalability	Target devices are different in hardware resources and screen resolution: • Mobile devices • Desktop computers
N11	Scalability	The solutions will run as browser based application on many operating systems as possible.
N12	Scalability	The solutions are able to run as several instances in a network.
N13	Scalability	The solutions include an effective handling of data with a minimal use of memory.
N14	Security	Outputs with information about warnings, errors, instructions and data sources for users have to be clear.
N15	Security	The protection of user data is enabled by the solutions.
N16	Usability	The solutions enable an intuitive and easy way of handling by users, especially easy map navigation.
N17	Usability	The solutions have a multi-language support.
N18	Usability	The solutions provide a responsive design.
N19	Usability	The solutions enable a high level of automation.
N20	Usability	The solution supports the use by disabled persons

Table 6: Aggregation of non-functional application requirements

4.3 Data Requirements

The basic structure for all applications and their requirements are geodata, containing spatial and attribute information (incl. metadata), which will be processed, analysed and visualized for the end users. Accurate and precise data are therefore a basic requirement for the realization of a lot of the application based functional and non-functional requirements, which include accuracy and precision, too. The stated data requirements of the applications for non-functional features, contents of data and data sources are the following.

ID	Category	Requirement	Description
D01	Non-Functional Data Requirements	Accuracy	Data are valid
D02	Non-Functional Data Requirements	Accuracy	Data are complete and includes metadata
D03	Non-Functional Data Requirements	Accuracy	Data are up to date
D04	Non-Functional Data Requirements	Accuracy	Data have a high and homogeneous temporal resolution.
D05	Non-Functional Data Requirements	Accuracy	Data have a high and homogeneous spatial resolution
D06	Non-Functional Data Requirements	Accuracy	Data are in the same datum
D07	Non-Functional Data Requirements	Availability	Preferred data are free of charge and open.
D08	Non-Functional Data Requirements	Availability	Data are reliable and almost permanent reachable.
D09	Non-Functional Data Requirements	Granularity	Temporal, spatial and other content attributes of data are comparable.
D10	Data Requirements	Content	The used data by solutions cover following content: • Environment • Urban development • Social and demographic information • Administrative data • Health and safety • Infrastructure • Aerial and satellite imagery • 3D LIDAR data • Economic information • Public and private transportation • Climate information • Tourism

			• Metadata
D11	Data Requirements	Coverage	For following regions data will be requested: • Poland • Veneto • France • Lombardy • Zaragoza • Berlin • Brandenburg • Europe • World
D12	Data Requirements	External systems	Following external systems will be requested for data: • Services by ArcGIS for Server, Geoserver and UMN Mapserver • ArcGIS Online • GDI-DE • Specialized software for land consolidation • Metaservices • Copernicus Urban Atlas • GIS-BROKER-FRAMEWORK • Services of European Location Network • FTP-Services • EasySDI • Services by OpenTripPlaner • Services of GeoNetwork • Google Maps • Geoportail • 52North SOS Server • Databases, e.g. PostgreSQL/ PostGIS
D13	Data Requirements	Formats	Following data formats will be used: • ESRI Shape • GeoTIFF • JPEG • JPEG2000 • PNG • PDF • DWG • XML • KML

			• MDB
D14	Data Requirements	Interfaces	Following standards and formats will be used for exchange of data: • OGC standards for WMS, WMST, WFS, WCS, WPS, SWE, SOS, SOS-T, CSW • INSPIRE standards for web services, data and metadata • XML, GML, KML

Table 7: Aggregation of application data requirements

4.4 Relation to Virtual Hub Requirements

This deliverable collects the requirements of the ten ENERGIC OD applications. The applications, beside their specific objective, are conceived as pilots to demonstrate the feasibility and effectiveness of the ENERGIC OD VH concept and realization. Therefore, the application requirements impact on VH requirements. In particular, the ENERGIC OD criterion for the elicitation of VH system requirements is that application requirements potentially shared by multiple applications should be considered as VH requirements. Vice versa, requirements that are specific of one or a few applications should be addressed directly by the application developers. For example, coordinate reference system transformations can be considered a common functionality to be provided by the VH. This approach complies with the VH objective of facilitating the use of open data, in particular, providing common functionalities for application development. The result of the analysis of pilot application requirements for eliciting VH requirements is included in the deliverable D5.1 (Virtual Hub – System Architecture, second release).

5 CONCLUSION

The presented requirements are derived from the specific requirements of each application to be developed. The following conclusions can be made:

- The stated requirements should not be considered independently, e.g. the non-functional requirement of accuracy dependents on the functional requirement of the requested metadata with quality features of used data. However, some general data requirements like the availability of metadata have to be fulfilled to enable the non-functional requirement of accuracy.

- In the context of the implementation, some functional requirements like data transformations can be implemented at different points of the application development through specific framework libraries related to the used programming language. Further, data transformation can also be carried out through requested interfaces. As a consequence, interfaces inherit application based requirements. In case of accuracy, interfaces have to provide data without loss of information.

- The availability of metadata is a relevant requirement to ensure data quality standards, to match different data sources, or to control data requests that enable performance requirements.

- Because of the different temporal status of development of each application and the

agreement with user groups some requirements are based on preliminary assumptions of the partners. Therefore it can be assumed that changes to stated requirements are very likely, but consideration of alternative state-of-the-art technologies and technical trends can compensate this effect.

- Most applications will be developed as prototypes and cover a limited regional extent of Europe. This spatial limitation affects basic data requirements as well as necessary data projections.

- To enable automated data access from external data sources, established and known standards and protocols will be used, e.g. OGC-standards, XML as well as HTTPS. Furthermore, HTTPS is one aspect to comply with the requirement of security.

- Related to the requirement of accuracy, proper data with the same requirement of quality will be needed. This point requires external systems and interfaces, which are able to provide data without loss of information to preserve the quality of data.

- The functional requirement of data exchange and non-functional requirement of interoperability include the ability of solutions to request external systems, which require authentication, e.g. by username and password. Besides the licence conditions of requested systems and data have to be known.

- Because of little information about concrete target devices, operating systems, browsers and versions of standards, it will be assumed that all currently established technologies and versions are required.

- Geodata, which include several raster and vector formats as well as attribute data, will be used by the applications. In this context OSM data have a key role, because OSM data are open and cover a wide range of the stated data contents in the data requirements. For that reason, most of all applications will use OSM data and require an interface with external systems, which provide OSM data.

- All the applications make use of the ENERGIC OD VHs demanding most of interoperability issues in accessing geospatial open data to them. Common requirements from multiple applications are proposed as VH requirements.

6 ANNEX A: Application and Software Requirements (1st Release)

Participant name:
Participant short name:
Participant number:
Title of application or service:
Editor of this document:
Further contact persons and details:

1. Introduction

This section describes the general background of the application or service to be developed.

1.1 Scope

Describe the software to be developed by name, function, unique features, benefits and field of application.

1.2. Interface with other Systems

Describe how the new application or service relates to other existing systems (hard- and software) and if appropriate the replacement of legacy systems.

1.3. Glossary

Define the terms used in this document.

2. Assumptions and Constraints

2.1. Assumption

State the assumption on which the new application or service is based. Maybe assumptions of:

- *Availability of data*
- *Future situations*
- *Developments in technology*

2.2. Constraints

State the constraints which will impact the development or the design of the new application or service, for example:

- *Regulations, policies, licenses*
- *Available resources like budget or time*
- *Quality and quantity of data*
- *Hardware and software limitation (for example, imposed by specific database, frameworks or libraries)*
- *Other standards*

(This paragraph contains partly inverse assumptions.)

3. Functional Requirements

By the description of the in- and outputs as well as the behaviour of the system or its units this

section states the specific functions of the new application or service.

Complete this section with one paragraph for each specific function.

4. Non-Functional Requirements

This section states and describes the specific, partial measurable, features of the new application or services. Examples for these features are: Performance, Usability, Reliability, Security, Portability, Availability, Maintainability, Correctness, Scalability, etc.

Complete this section with one paragraph for each non-functional requirement.

5. Data Requirements

With respect to the focus on geodata and other data this section describes the data requirements by providing data entities and their decomposition, for example the API or service which provide the data and the required format and kind of data.

Complete this section with one paragraph for each data requirement.

6. Appendices

Here paragraphs of missing application specific aspects or other detailed information about users, development and systems can be added.

6.1 Development

State the main components and technologies, which are used for realization of the new applications and services, for example programming language and libraries.

7 ANNEX B: Application and Software Requirements (2nd Release)

Participant name:
Participant short name:
Title of application or service:

Revision History

Version	Date	Modified by	Comments

Glossary

All abbreviations and terms, which are necessary to understand this document, must be listed.

1. Introduction

This section describes the purpose and the scope of the solution to be developed, the general objectives of the solution.

2. General Description

2.1. Product Perspective

The perspective of the solution states whether the solution will be part of an existing system of solutions or is a new solution. In context of ENERGIC OD the Virtual Hubs must be stated.

2.2. Product Functions

This section states the general functions and features of the solution to be developed. In the following sections about functional, non-functional and data requirements, these functions and features will be described in detail. This general functions and features of the solution are needed to make the relation of users and system components understandable.

2.3. User Characteristics

The major impact on the solution requirements should have the users. This section describes the involvement of users. The subsections 2.3.1 "User Classes", 2.3.2 "Relation of Users and System Components" and 2.3.3 "Use Cases" specify the characteristics of users in detail.

2.3.1. User Classes

This subsection groups and describes the users by frequency of use, available solution functions or user skills, e.g. administrator, public unregistered user or registered user. For each user class the significance must be specified, e.g. major and minor user class or a similar approach of ranking.

2.3.2. Relation of Users and System Components

This subsection presents in a general way the relation between user classes and the major solution components from the user-related point of view. For example, the administrator can

register via the administrator interface of the solution a new user. This means that an unregistered user becomes a registered user. The specific use cases will be described in section 2.3.3.

2.3.3. Use Cases

This section is related to section 2.3.2. "Relation of Users and System Components" and specifies the use cases for the user classes and the solution to be developed.

For each use case a subsection of the following structure must be inserted.

2.3.3.1 <Title of Use Case>

Diagram:

Should be possible for the most use cases

Description:

A short description of the use case

Pre-conditions:

State the conditions, which have to be fulfilled before this use case can be initiated.

Trigger:

Specify the user action, which activates the following sequence of activities.

Sequence of activities:

Based on the preconditions, the actions to achieve the preconditions must be specified.

Post-conditions:

State the conditions after the execution of the sequence of activities.

Extensions:

Refer to another use cases, which extend this use case.

2.4. Operating Environment

The requirements of the solution to be developed are closely related to the environment in which the solution will operate. This means that specified solution requirements could affect the features of the operating environment as well as the features of the operating environment can affect the solution requirements. The operating environment is specified by hardware and software.

2.4.1. Hardware

This subsection states and specifies the hardware in which the solution will operate.

2.4.2. Software

This subsection states and specifies the software in which the solution will operate, including used libraries and software version.

2.5. User Documentation

A general solution requirement is the writing of a user documentation, which is set by the "ENERGIC OD - Description of Work". The kinds of user documentation must be stated, e.g. user manuals, on-line help, tooltips or tutorials). The user documentation must be related to the identified user classes and should include information about delivery formats and standards to

be used.

2.6. Assumptions

This section describes the assumed factors, which will affect the solution development, e.g. the expected degree of utilisation, the Virtual Hubs or the cooperation with users.

2.7. Constraints

This section describes the constraints, which affect the solution development. The constraints include licences of used technologies and data, aspects of security and personal data, hardware or programming language capabilities. The constraints exclude inverse assumptions related to section 2.6.

3. External Interface Requirements

3.1. User Interfaces

*This section describes the **logical** characteristics of each interface between the solution and the user. The description must be related to the user classes in section 2.3.1. Style guides, available functions, error display and the kind of user interaction can describe the features of the user interfaces. In section 3.5 the technical features of the communication between the users and the solution will be described.*

3.2. Hardware Interfaces

*This section describes the **logical** characteristics and relation of the solution and the used hardware. In particular, the following aspect must be described: The solution components are executed on different hardware components. For example, a SSD-storage can be used to handle a large number of server-side temporary or cached files or a solution component requires specific hardware parameters like the size of the swap to hold temporary files. In this case, the control of the swap must be described as well as the nature of data, e.g. temporary user data. In section 3.5 the technical features of the communication between the hardware and the solution will be described. Related to the solutions of the ENERGIC OD project most of the hardware communication will be realised by the use of external libraries and other software products like database or server software. If a hardware interface is realised by the use of external libraries and other software products the specific technical communication interfaces do not have to be considered in section 3.5, the reference to the software documentation is sufficient.*

3.3. Software Interfaces

This section describes the logical connections between the solution and other specific software. This means that the specific software components, including the name and version, and the incoming as well as outgoing data, must be described. In section 3.5 the technical features of the communication between the software and the solution will be described. The communication between the solution and the Virtual Hubs as well as other external data sources like Web Map Services will be described in section 3.4.

3.4. Virtual Hubs and Data sources

This section describes the logical connections between the solution components and the Virtual

Hubs and other external data sources like Web Map Services. This description includes the nature of data. In section 3.5 the technical features of the communication between the Virtual Hubs as well as other data sources and the solution will be described.

3.5. Communication Interfaces

This section describes the communication interfaces, which are used by the solution, e.g. FTP, HTTP or e-mail. The communication interfaces are related to the previous sections of external interfaces (Virtual Hubs, user, hardware and software interfaces). Internal interfaces between the components of the solution can be described to clarify any kind of transformation, which will be processed inside the solution and set requirements to external interfaces. The features of communication interfaces can be described by the formatting of data, standards and security issues as well as performance indicators.

4. Functional Requirements

This section specifies in consideration of the previous sections the functional requirements of the solution. Each requirement in this section must be traceable by id, complete, consistent, unambiguous, testable, ranked and related to the use cases in section 2.3.3. To facilitate this kind of specification the following template table must be used. The values of the requirement attributes are:

ID:

- *F<number of functional requirement><number of application>*
- *In case of a one-digit number of functional requirement, the leading digits must be filled-up with '0'*
- *The numbering of functional requirements starts at 1*
- *E.g. F01A7 for the first functional requirement of the "Biodiversity Bird Indicator"*

Requirement:

- *Title of Requirement*
- *The following titles are already established by the first version of D6.1 and can be used: Editing, Exchange of data, Monitoring, Navigation, Processing of data*
  Description, Query, Selection of data, User access, Visualisation

Priority:

- *Ranking of the priority can be indicated by "High", "Medium", "Low"*

Use Case Reference:

- *Reference to use cases in section 2.3.3. (can be related to more than one use case)*
- *The value is the number of subsection and the title of the use case*

Description:

- *A brief definition of the requirement*

ID	
Requirement	
Priority	

Use Case Reference	
Description	

5. Non-Functional Requirements

This section specifies the non-functional requirements of the solution. A reference to the use cases is not required. To facilitate this kind of specification the following template table must be used. The values of the requirement attributes are:

ID:

- *N<number of non-functional requirement><number of application>*
- *In case of a one-digit number of non-functional requirement, the leading digits must be filled-up with '0'*
- *The numbering of non-functional requirements starts at 1*
- *E.g. N01A7 for the first non-functional requirement of the "Biodiversity Bird Indicator"*

Requirement:

- *Title of Requirement*
- *The following titles are already established by the first version of D6.1 and can be used: accessibility, accuracy, availability, interoperability, maintenance, performance, portability, scalability, security, usability*

Priority:

- *Ranking of the priority can be indicated by "High", "Medium", "Low*

Description:

- *A brief definition of the requirement*

ID	
Requirement	
Priority	
Description	

6. Data Requirements

This section specifies the data requirements of the solution. If appropriate, a reference to the use cases should be set. To facilitate this kind of specification the following template table must be used. The values of the requirement attributes are:

ID:

- *D<number of data requirement><number of application>*
- *In case of a one-digit number of data requirement, the leading digits must be filled-up with '0'*
- *The numbering of data requirements starts at 1*
- *E.g. D01A7 for the first data requirement of the "Biodiversity Bird Indicator"*

Requirement:

- *Title of Requirement*
- *The following titles are already established by the first version of D6.1 and can be used: accuracy, availability, granularity, content, coverage, external systems, formats, interfaces*

Priority:

- *Ranking of the priority can be indicated by "High", "Medium", "Low*

Use Case Reference:

- *Reference to use cases in section 2.3.3. (can be related to more than one use case)*
- *The value is the number of subsection and the title of the use case*

Description:

- *A brief definition of the requirement*

ID	
Requirement	
Priority	
Use Case Reference	
Description	