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Ref. Ares(2024)8019978 - 12/11/2024



### D.4.3.

Dalia Knowledge Hub – initial release

# DALIA DANUBE REGION WATER LIGHTHOUSE ACTION

Grant Agreement Number: 101094070

Deliverable name:	D.4.3. Dalia Knowledge Hub – initial release
Deliverable number:	4.3
Deliverable type:	Report
Work Package:	WP 4
Lead Beneficiary:	CCSS
Contact person:	Jiří Kvapil
Dissemination level:	Public
Due Date for Deliverable:	March 30th, 2024

PROJECT DETAILS

[DALIA-DANUBE.eu](https://DALIA-DANUBE.eu)

<b>ACRONYM</b>	DALIA
<b>Title</b>	Danube Region Water Lighthouse Action
<b>Grant Agreement Number</b>	101094070
<b>Call</b>	HORIZON-MISS-2021-OCEAN-02
<b>Project Coordinator</b>	ORSZAGOS VIZUGYI FOIGAZGATOSAG (OVF)

## DELIVERABLE DETAILS

<b>DELIVERABLE TYPE</b>	
<b>Deliverable status</b>	Final
<b>Dissemination level</b>	Public
<b>Due date</b>	30 <sup>th</sup> March 2024
<b>Submission date</b>	[3, 2024]
<b>Work package</b>	WP 4
<b>Deliverable leader</b>	Jiří Kvapil
<b>Deliverable author(s)</b>	Jiří Kvapil, Karel Charvát, František Zdražil

## REVISION HISTORY

Version	Date	Reviewer	Modifications
1.0	26/3/2024		Final draft
1.1	29/3/2024	Anastasia Perouli, Boglárka Lakatos	Final version
2.0	30/9/2024		Updates after review



## ACKNOWLEDGEMENTS

The work described in this publication was subsidised by Horizon Europe (HORIZON) framework through the Grant Agreement Number 101094070.

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## LIST OF ABBREVIATIONS

Abbreviation	Full name
DALIA KMS	DALIA Knowledge and Monitoring System
WMS	Web Map Service
WFS	Web Feature Service
CSW	Catalog Service for Web
NAT	Network Address Translation
WSGI	Web Service Gateway Interface
DIH	Digital Innovation Hub
CMS	Content Management System



## EXECUTIVE SUMMARY

Dalia Knowledge and Monitoring System (KMS) portal is central place for DALIA information and data dissemination and knowledge sharing. Information on DALIA pilot sites and later associated regions is published on the DALIA KMS. This document describes development, and all the parts of the system and ingestion of first legacy data. The DALIA KMS would be continuously updated as the project activities are moving forward.



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## 1. INTRODUCTION

DALIA Knowledge and Monitoring System (KMS) <https://kms.dalia-danube.eu> is the Digital Innovation Hub for Water Management, providing a user-friendly platform to explore and access innovative water management solutions. Built on a content management system, DALIA KMS offers four key sections catering to both internal and external users:

1. **Interaction Space:** Forums, discussions, and wikis facilitate collaboration and knowledge sharing among stakeholders.
2. **Learning Space:** Publication of training and replication materials supporting widespread dissemination of knowledge and methodologies developed through the project.
3. **Experimentation Space:** Spatial and non-spatial based analytics and visualization tools enable testing and exploration of new approaches.
4. **Development and Hosting Space:** This space allows pilot localities to create virtual environments for developing their water management applications.

Beyond these core functionalities, DALIA KMS plans to offer additional features that leverage various technologies. To optimize service for pilot programs, an initial analysis will assess their context, data availability, analytical needs, existing tools, and required interfaces.

Based on joint and individual data needs, DALIA KMS will identify common data sources with broad geographical coverage, valuable for water management applications. These datasets will be accessible through direct visualization services.

DALIA KMS seamlessly integrates the data analysis and presentation tools within the project, appearing as a unified platform from the user's perspective. Map, sensor, meteorological and other data sources are accessed via defined APIs and published on the hub.

Three deployment scenarios are foreseen within the project.

- **Centralized Service Provider:** This configuration serves as the backbone for DALIA's core services.
- **Pilot-Hosted Applications:** Pilots can choose to host their applications within DALIA's private cloud environment, utilizing this template.
- **Legacy Infrastructure Integration:** A package repository and service provider option allow pilots to integrate their applications with existing infrastructure.

DALIA KMS prioritizes flexibility, offering options for pilots to maximize adoption and integration compared to traditional, monolithic systems. Each layer of the architecture is described, with candidate components identified for each requirement. Where applicable, multiple options are presented to facilitate integration with existing systems and environments. Open standards ensure smooth communication between all components.

### Living Lab Approach and Continuous Development

Following an agile and iterative development process, this version serves as the initial DALIA KMS specification, where only basic concepts are implemented. Concrete implementation details and pilot data will be added throughout later project progress, and user requirements and pilot planning will affect the development. Currently, the focus is on establishing a reference platform, which will be continuously developed throughout the project lifecycle following the living lab methodology aiming at final version of DALIA KMS being available in 33 months from now on.

## 2. TECHNOLOGY

Technology used for development and running the DALIA KMS, either hardware or software, was selected as well tested and known backed by many years of experience and successfully carried out projects. New components and technologies are naturally constantly brought on board as the overall technical development advances, but always only after a thorough testing.

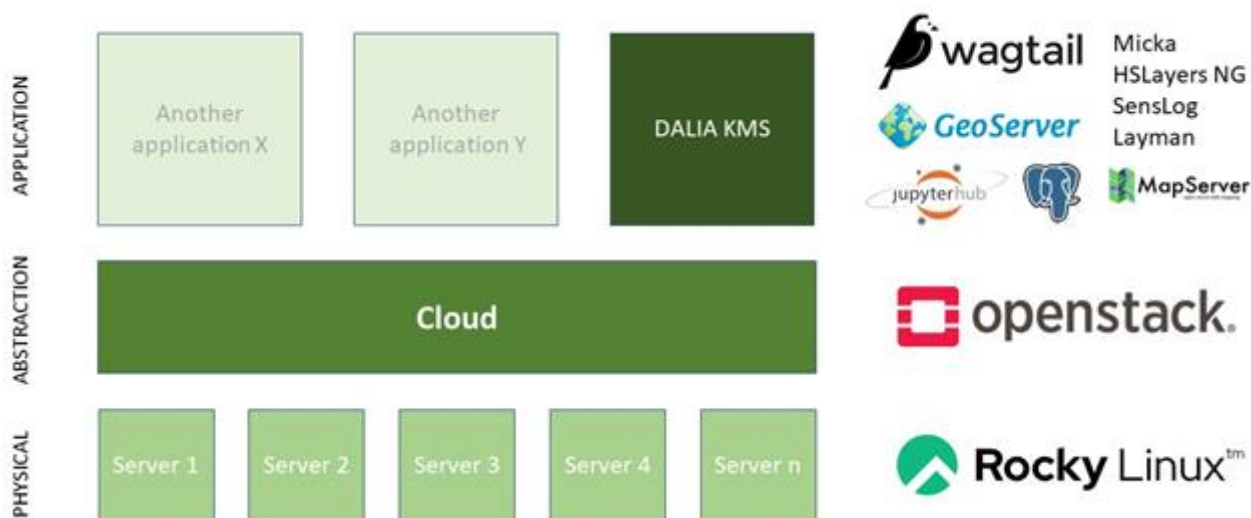


Figure 1: Cloud infrastructure schema

### 2.1. Hardware - OpenStack for DALIA KMS

DALIA KMS runs on internal cloud solution run by CCSS that offers a robust and customizable platform specifically designed to support the development and deployment of services for Digital Innovation Hubs (DIHs). Built on a foundation of dedicated servers located in Prague, Czech Republic, the cloud solution provides complete control and ensures the utmost security for DALIA data and applications.

#### Open Source Powerhouse

Cloud solution powering DALIA KMS leverages the power of OpenStack, a leading open-source cloud software platform. This technology allows for efficient utilization of hardware resources by seamlessly combining individual servers into a unified, centrally managed cloud environment.

#### Extensive Functionality



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OpenStack empowers DALIA KMS with a comprehensive suite of services, including:

- **Virtualization:** Create and manage virtual machines (VMs) on demand, offering a cost-effective and flexible way to run diverse applications.
- **Block Device Sharing:** Efficiently share storage resources across VMs, ensuring data accessibility while optimizing storage utilization.
- **Distributed Computing:** Harness the combined processing power of multiple servers for computationally intensive tasks, significantly accelerating workloads.
- **Docking Technology Support:** Integrate containerization technologies like Docker for simplified application deployment and management.
- **Advanced Networking:** Benefit from a robust network stack that enables low-level network isolation, including VLAN support, Network Address Translation (NAT), and an integrated firewall, guaranteeing secure and controlled network communication.
- **Granular User Management:** Implement fine-grained user access controls to logically segment OpenStack instances into isolated environments, replicating the functionality of separate physical servers.

### **Enhanced Monitoring and Management**

OpenStack prioritizes user experience. Through a comprehensive web dashboard, administrators gain a clear and detailed overview of current resource utilization, enabling proactive management and resource allocation. Additionally, robust reporting capabilities offer valuable insights into historical resource usage patterns.

### **Reliable Backups and Disaster Recovery:**

Data security is paramount. DALIA KMS employs a rigorous backup strategy, ensuring the integrity and availability of critical data. Backups are conducted at least weekly and more frequently for mission-critical infrastructure. CCSS manages its own dedicated backup infrastructure, providing complete control and guaranteeing data restoration capabilities in the event of unforeseen circumstances.

### **Rapid Deployment and Scalability**

DALIA KMS caters to evolving needs. New virtual servers can be provisioned within minutes in response to user requests, eliminating delays and ensuring rapid application deployment. A library of pre-configured operating system snapshots is readily available for immediate use, further streamlining the deployment process.

### **Powering Digital Innovation Hubs**

CCSS strategically utilizes OpenStack as the foundation for its Digital Innovation Hub services. A dedicated production line has been developed, leveraging software tools within the DALIA KMS framework. Detailed list and description of functionalities of the software tools is presented in following chapters.

## **2.2. Software**

The whole technical solution is based on open source products and own development built upon open standards and well described APIs. Open data is used where possible.

### 2.3. DALIA KMS software architecture

DALIA KMS relies on the **three-tier architecture** that is often referred to as a multi-tier architecture, it breaks down an application into distinct layers, each with a specific responsibility. This separation of concerns fosters modularity, maintainability, and scalability, making it a popular choice for web applications and complex software systems like digital Innovation hubs.

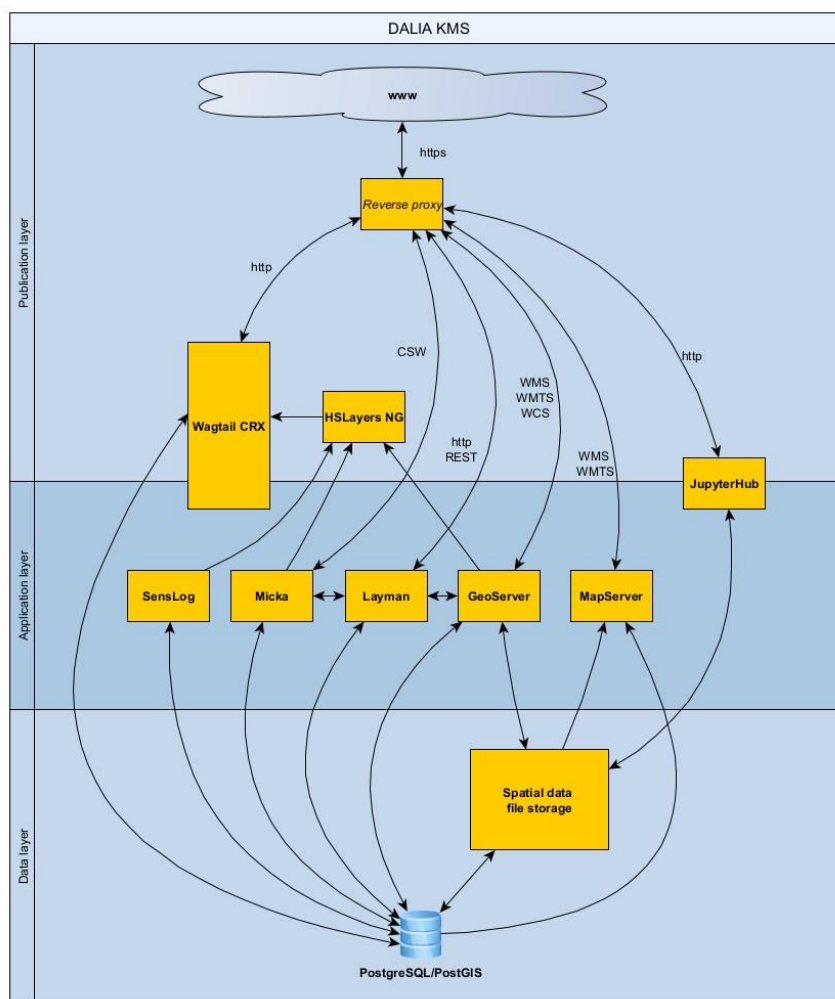


Figure 2: DALIA KMS schema

The three tiers that form the backbone of DALIA KMS are following.

#### 1. Presentation Tier (User Interface, Publication layer):



This tier acts as the user's window into the application. It represents everything the user sees and interacts with, typically a web interface or a mobile app. The presentation tier collects user input through forms, buttons, and other interactive elements. It then processes this input and displays the necessary information or results back to the user.

Think of it as the waiter in a restaurant. The waiter receives your order (user input), communicates it to the kitchen (business logic), and then delivers the prepared food (processed information) to your table (user interface).

**Technologies used in the DALIA KMS publication layer include:**

- HTML, CSS, and JavaScript for web interfaces
- React and Angular frameworks for building interactive web applications

**2. Business Logic Tier (Application layer):**

The business logic tier, also known as the application tier, is the heart and soul of the application. It houses the core functionalities and business rules that define the application's behavior. This tier receives user input from the presentation tier, processes it according to the business logic, and interacts with the data tier to retrieve or manipulate data as needed.

Imagine the kitchen in the restaurant analogy. The chefs (business logic) receive the order (user input) from the waiter, interpret it based on the menu (business rules), prepare the food (process the data), and hand it back to the waiter (presentation tier) for delivery.

**Technologies used in the DALIA KMS application layer tier include:**

- Python Programming language
- Application servers: Apache (WSGI), Tomcat

**3. Data Tier:**

The data tier, also known as the persistence tier, is responsible for storing and managing the application's data. It acts as the permanent repository for data accessed by the business logic tier. Databases like MySQL, Oracle, or PostgreSQL are the workhorses of this tier. They ensure data integrity, security, and efficient retrieval when needed by the business logic.

Think of it as the pantry in the restaurant. The chefs (business logic) access the pantry (data tier) to retrieve ingredients (data) required for preparing the food (processing information). The pantry ensures that the ingredients are fresh, properly stored, and readily available.

**Technologies used in the DALIA KMS data layer include:**

- PostgreSQL relational databases
- File systems for storing non-relational data

The separation of concerns in three-tier architecture offers several advantages:

- **Modularity:** Each tier performs a specific function, making it easier to develop, maintain, and modify individual components independently.

- **Scalability:** Different tiers can be scaled independently based on their specific needs. For instance, you can scale the presentation tier to handle more users while scaling the database server to accommodate growing data volumes.
- **Maintainability:** Fixing bugs or adding new functionalities becomes easier as developers can focus on a specific tier without worrying about the intricate workings of the entire system.
- **Security:** By placing the data tier behind a secure layer, the three-tier architecture enhances data security.
- **Reusability:** The business logic and data access layers can often be reused across different applications, saving development time and resources.

### Enhanced Security and Streamlined Management with Reverse Proxy

For increased security, manageability, and scalability, the entire DALIA KMS resides within a Network Address Translation (NAT) environment, protected by a reverse proxy server. This reverse proxy acts as a single-entry point for all user requests directed towards the kms.dalia-danube.eu domain.

#### Benefits of the Reverse Proxy

- **Security:** The reverse proxy shields the internal components of the DALIA KMS system from direct internet access, adding an extra layer of protection.
- **Manageability:** The proxy manages incoming requests, directing them to the appropriate backend server based on the specific path within the URL (URI path). This simplifies system administration by presenting a unified address (<https://kms.dalia-danube.eu>) despite the heterogeneous nature of the backend servers (e.g., portal, map server).
- **Scalability:** The reverse proxy can be easily configured to handle increased traffic volumes, ensuring the DALIA KMS system scales efficiently as user demands grow.

In essence, the reverse proxy acts as a central traffic controller, ensuring a secure and efficient user experience while simplifying the management of the underlying infrastructure.

#### 2.3.1. Hub4Everybody

Hub4Everybody is a one-of-a-kind, modifiable solution for publishing, sharing, and collaborative management of geospatial data. It encompasses a wide range of data types, including professional data, measurements, research project outputs, student work results, teaching materials, sensory maps, field survey visualizations, and other maps, tables, or databases.

Key Features:

- **Seamless Data Upload and Management:** Easily upload your data to the Hub4Everybody environment, modify it as needed, and adjust sharing parameters for specific target groups.
- **Open-Source Alternative:** Hub4Everybody serves as an open-source alternative to existing commercial solutions, offering a broader range of customization options.



- **Versatile Functionality:** It combines the functionality of online office software with a spatial data editorial system, providing a comprehensive platform for geospatial data management.

#### Data Types Supported:

- Professional data and measurements
- Research project outputs
- Student work results
- Teaching materials
- Sensory maps
- Field survey visualizations
- Other maps, tables, or databases

#### Benefits:

- **Flexibility:** The modifiable nature of Hub4Everybody allows users to tailor the platform to their specific needs.
- **Openness:** The open-source nature of the platform encourages community contributions and ensures long-term sustainability.
- **Versatility:** The platform's support for a wide range of data types and functionalities makes it a valuable tool for various geospatial data management applications.

Hub4Everybody is a powerful and versatile platform that empowers users to effectively manage, share, and collaborate on geospatial data. Its unique features and open-source nature make it an ideal solution for individuals, organizations, and communities seeking a comprehensive and customizable geospatial data management platform.

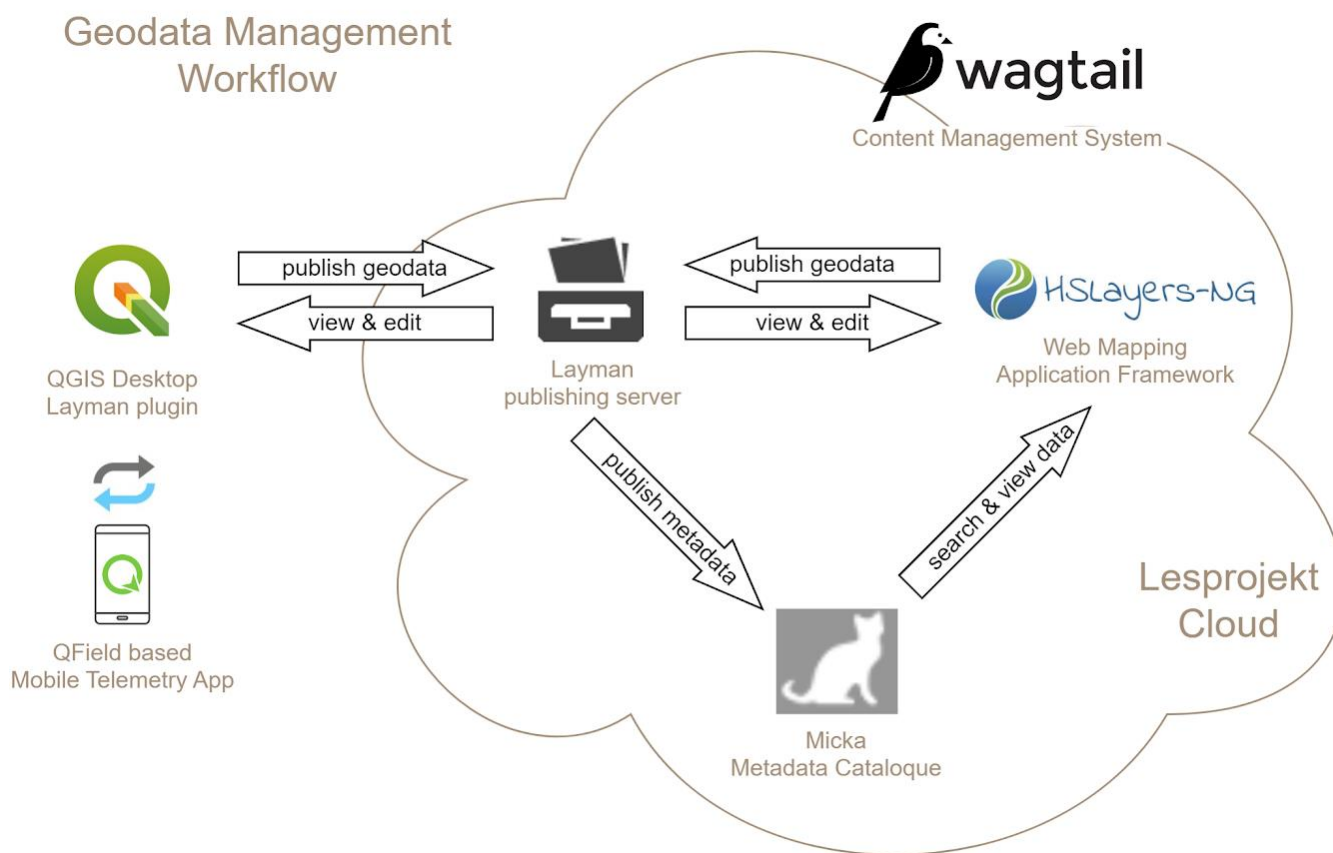


Figure 3: Hub4Everybody schema

The editorial system serves as the cornerstone of the geospatial data processing system, acting as both the foundation for a user-friendly web portal and a central hub for navigating the various components within the system.

For the editorial system, we have opted for the Wagtail CMS platform, enhanced with the CodeRed CMS extension. Wagtail stands out as a leading open-source Content Management System (CMS) trusted by organizations of all sizes, including prominent names like Google, NASA, and the British NHS. Built upon the Django framework with Python as its primary development language, Wagtail offers exceptional extensibility. Functionality can be readily expanded through custom widgets, page templates, permission configurations, and other system parameters. This inherent flexibility paves the way for seamless integration with potentially existing organizational systems, such as a city geoportal, should that need arise in the future. Wagtail thrives thanks to a vibrant community that fosters a continuous stream of valuable plugins and extensions.

This selection of Wagtail CMS as the editorial system's platform brings several advantages to the table. First and foremost, its inherent flexibility allows for customization to perfectly align with the organization's specific needs. Furthermore, being open source ensures long-term sustainability and fosters ongoing contributions from the community. Finally, the active Wagtail community provides a wealth of support and resources, further solidifying its position as the ideal choice for this project.



### 2.3.2. PostgreSQL database

PostgreSQL, a widely adopted open-source relational database management system (RDBMS), serves as a robust foundation for managing various data types. When coupled with the PostGIS extension, PostgreSQL transforms into a comprehensive Geographic Information System (GIS) database. PostGIS unlocks a suite of functionalities specifically designed for storing, manipulating, and analyzing geospatial data.

The integration of PostGIS empowers users to represent diverse geographic features – points, lines, polygons, and even 3D geometries – directly within the PostgreSQL database. This seamless integration eliminates the need for separate storage solutions for geospatial data, fostering a centralized and efficient data management environment.

PostGIS boasts a rich set of spatial functions that go beyond basic storage and retrieval. These functions enable complex spatial operations such as calculating distances and areas, as well as performing advanced geometric analyses. These analytical capabilities empower researchers and data scientists to extract valuable information from their geospatial datasets.

Spatial indexing, a cornerstone of PostGIS functionality, significantly enhances the efficiency of retrieving specific locations based on geospatial queries. This indexing mechanism allows for rapid filtering and retrieval of relevant data, making it a crucial factor for applications that demand real-time geospatial information.

The open-source nature of PostgreSQL and PostGIS fosters a vibrant community that contributes to extensive documentation and a wealth of resources. This robust support system empowers users of all levels to leverage the power of geospatial data management within their PostgreSQL databases.

PostgreSQL's robust data management capabilities, coupled with PostGIS's specialized functionalities, create a powerful duo for handling geospatial data. This integrated solution streamlines data management, facilitates efficient retrieval, and empowers in-depth spatial analysis, paving the way for informed decision-making across various disciplines.

### 2.3.3. HSLayers

HSLayers-NG framework is the open source web mapping component (<https://ng.hslayers.org/>). CCSS had been actively developing this tool for a long time, and it can be significantly customized or functionally extended depending on the specific requirements of the system.

Moreover, there is already a functional integration with the Wagtail CMS in the form of a map widget. This widget enables straightforward map creation within all HTML pages of the content management system, including detailed configuration of map layers and tools, if required.

#### Key Features of the HSLayers Mapping Component:

- **Map Field for Data Visualization:** Provides a dedicated map field for visualizing geospatial data.
- **Publication of Map Layers and Maps:** Facilitates the publication of individual map layers and entire maps.
- **Viewing Outputs of Other Users:** Allows users to view and explore the map outputs created by other users.
- **User-defined Map Layers and Services:** Empowers users to add additional map layers and services, including external ones.
- **User-driven Data Drawing and Editing:** Offers user-friendly tools for drawing and editing geospatial data directly on the map.

- **Export and Printing of Map Content:** Supports the export and printing of map content, including any added or drawn data.

**Comparison of Multiple Map Layers:** Provides a powerful tool for comparing two or more map layers within a single window using a slider.

### Benefits of Using HSLayers:

- **Open-Source:** Being open-source, HSLayers ensures long-term sustainability and encourages community contributions.
- **Extensibility:** The framework's high extensibility allows for tailored customization to meet specific project requirements.
- **Active Development:** The HSLayers project is actively developed and maintained, ensuring continuous improvements and new features.
- **Wagtail Integration:** The existing integration with Wagtail CMS simplifies map creation and management within the content management system.

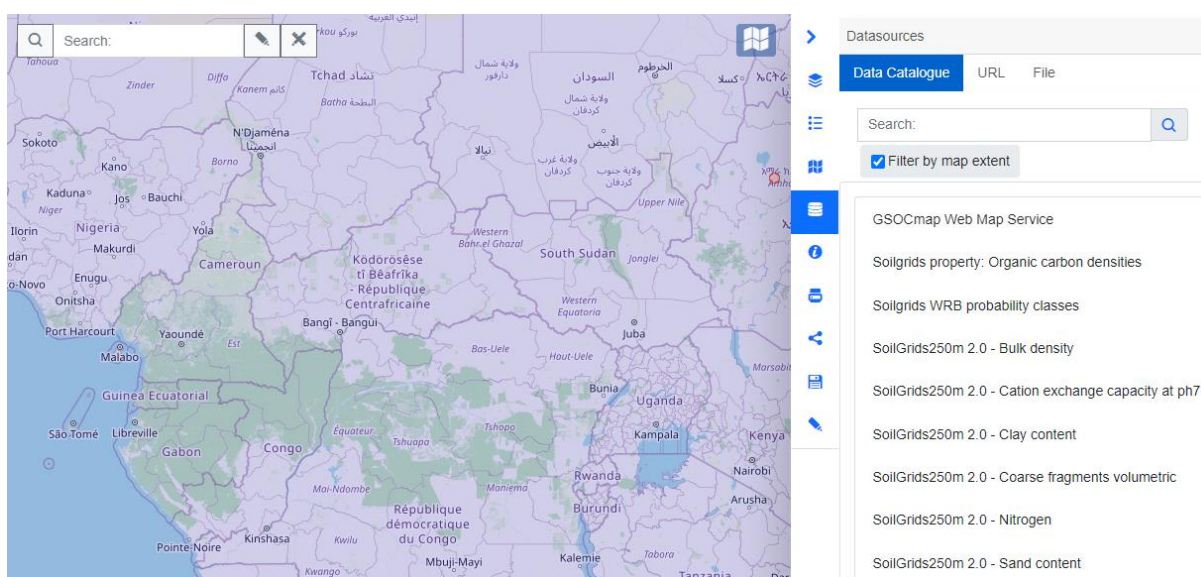


Figure 4: HSLayers user interface

HSLayers web mapping component offers a robust and flexible solution for visualizing, publishing, and interacting with geospatial data. Its open-source nature, extensibility, and active development make it an ideal choice for a wide range of projects.



### 2.3.4. MICKA

MICKA is a comprehensive system for the management and publication of spatial data metadata. It is built on the ISO 191xx and INSPIRE standards and supports the OGC CSW 2.0.2 ISO AP-1.0 catalog service. Additionally, MICKA offers a range of advanced features and supports various other standards, ensuring interoperability with other applications.

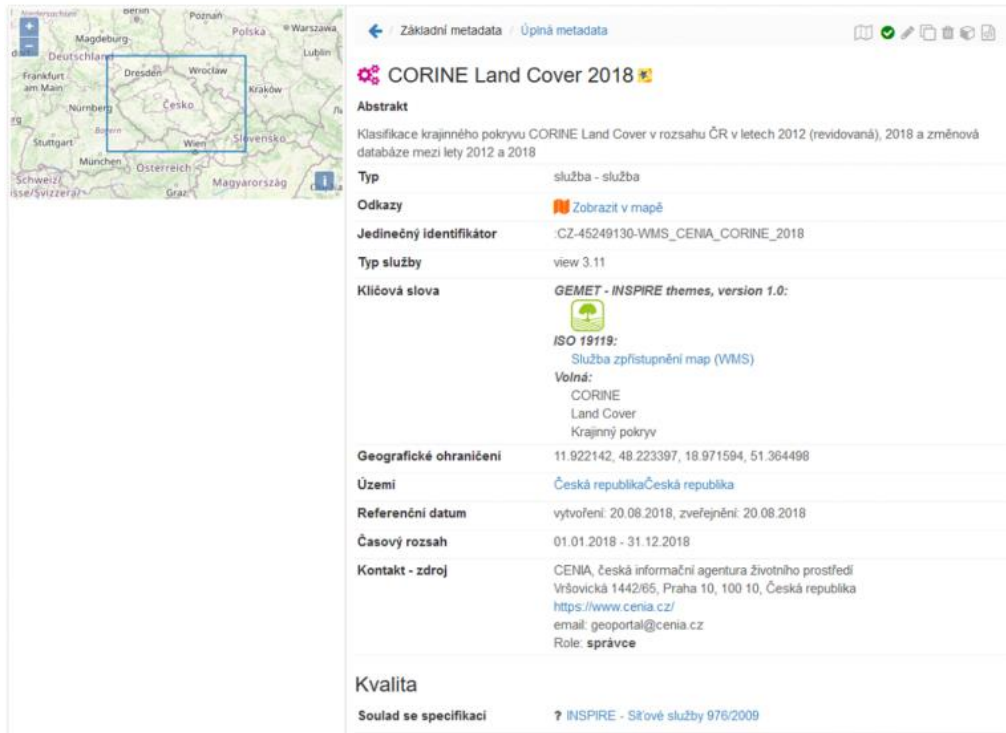


Figure 5: MICKA user interface

#### MICKA Key Features:

- **Online Metadata Editing:** MICKA provides a user-friendly web application for online metadata editing.
- **CSW 2.0.2 ISO-AP Support:** The system fully supports CSW 2.0.2 ISO-AP, including transactions and harvesting.
- **Feature Catalogue Management:** MICKA enables efficient management of feature catalogues according to ISO 19110.
- **Dublin Core Metadata Support:** The system supports metadata based on the Dublin Core standard (ISO 15836).
- **Import from OGC Services:** MICKA facilitates metadata import from various OGC services, including WMS, WFS, CSW, and WCS.
- **Metadata Import from ISO 19139, CKAN, and Others:** The system supports metadata import from various formats, including ISO 19139, CKAN, and others.
- **Multilingual Metadata:** MICKA allows for the creation and management of multilingual metadata.
- **External Registry and Thesaurus Integration:** The system can be integrated with external registries and thesauri, such as INSPIRE registries, GEMET, and SPARQL.
- **Configurable User Vocabularies:** MICKA allows for the configuration of user-defined vocabularies.
- **INSPIRE Atom Download Service:** The system offers the option to create an INSPIRE Atom download service.
- **Built-in Metadata Validator:** MICKA features a built-in metadata validator with the ability to configure multiple profiles.

## User Interface:

- **Responsive Design:** MICKA's user interface is responsive, ensuring optimal usability on various devices.
- **Multilingual Environment:** The system supports multiple languages, enabling a user-friendly experience for users with different language preferences.
- **Customization Capabilities:** MICKA allows for customization based on user needs using templates.
- **Contextual Help:** The system provides contextual help to guide users and enhance usability.
- **Output Formats:** ISO 19139 XML, ATOM, KML, GeoDCAT-AP, JSON, PDF, HTML, RDFa, OAI-PMH, MARC21
- **OpenSearch and Google Dataset Search Console Support:** MICKA supports OpenSearch and Google Dataset Search Console, facilitating data discovery and access.
- **User Extensions via Templates:** The system allows for user extensions using templates, providing flexibility and customization options.

MICKA offers a catalog client that can be integrated into geoportals. The client is used in various portals, including the National INSPIRE Geoportal of the Czech Republic.

## Catalog client key features:

- **CSW 2.0.2 Based:** The catalog client is built on CSW 2.0.2, ensuring interoperability and standards compliance.
- **Parallel Query Support:** It allows for parallel queries to multiple catalogs, enhancing efficiency and data retrieval speed.
- **User-defined Catalog Integration:** The client supports the addition of user-defined catalogs, providing flexibility and customization options.
- **WMS Visualization:** The client enables the visualization of discovered WMS services in a map application.
- **Metadata Output:** It offers various metadata output formats, including HTML, PDF, RDFa, and GeoDCAT-AP.

MICKA also includes a **metadata validator** that can be used to validate spatial data metadata and OGC services against INSPIRE requirements and the national metadata profile of the Czech Republic. The validator can be used as a standalone application or service, as implemented in the National INSPIRE Geoportal of the Czech Republic. It is also available as part of the MICKA metadata catalog.

MICKA and its associated catalog client and metadata validator provide a comprehensive suite of tools for the effective management, publication, and validation of spatial data metadata. The system's support for various standards, its user-friendly interface, and its extensive customization options make it a valuable solution for organizations and individuals working with spatial data.

### 2.3.5. Layman

Layman facilitates the online publication of geospatial data through a Representational State Transfer (REST) Application Programming Interface (API). It offers two publication paradigms: layers and maps. Layers represent individual vector or raster datasets, including time series for raster data. Maps are collections of these layers.



Layman exhibits broad data format support, accepting vector layer data in GeoJSON, Shapefile, or directly from PostGIS tables referenced by PostgreSQL connection URIs. Similarly, raster data can be uploaded in GeoTIFF, JPEG2000, PNG, and JPEG formats. Additionally, Layman supports styling for vector data via Styled Layer Descriptor (SLD), Symbology Encoding (SE), and QGIS Style File Format. Map definitions are specified in the HSLayers Map Composition format.

Asynchronous chunk upload enables seamless upload of large files from web browsers. Layman utilizes OAuth2 for user authentication and enforces authorization by granting specific users read/write access to individual layers and maps. Processing tasks are handled asynchronously to enhance performance.

Layman offers a comprehensive suite of services through URL endpoints, including a REST API, Web Map Service (WMS), Web Feature Service (WFS), and Catalogue Service for Web (CSW). The platform prioritizes security, providing documented details on its security system, data storage practices, and proxying mechanisms. Layman leverages environment variables for configuration flexibility.

The platform leverages a robust technology stack, including Docker containers, Python programming language, Flask web framework, PostgreSQL database management system with PostGIS extension, GDAL geospatial data processing library, QGIS Server and GeoServer for geospatial services, OpenLayers for web mapping, Celery for distributed task queuing, and Redis for in-memory data storage.

### 2.3.6. Senslog

SensLog is an open-source platform designed for comprehensive sensor data management. It encompasses functionalities for data ingestion, storage, management, analysis, and publication. The platform exhibits adaptability for both web and cloud deployments.

SensLog caters to a diverse range of sensor types, including static in-situ sensors, mobile sensor carriers, and data acquired through Volunteered Geographic Information (VGI) via smart devices. Data storage within SensLog leverages a relational data model implemented using PostgreSQL as the Relational Database Management System (RDBMS). PostGIS, a spatial extension for PostgreSQL, empowers SensLog with spatial data handling capabilities.

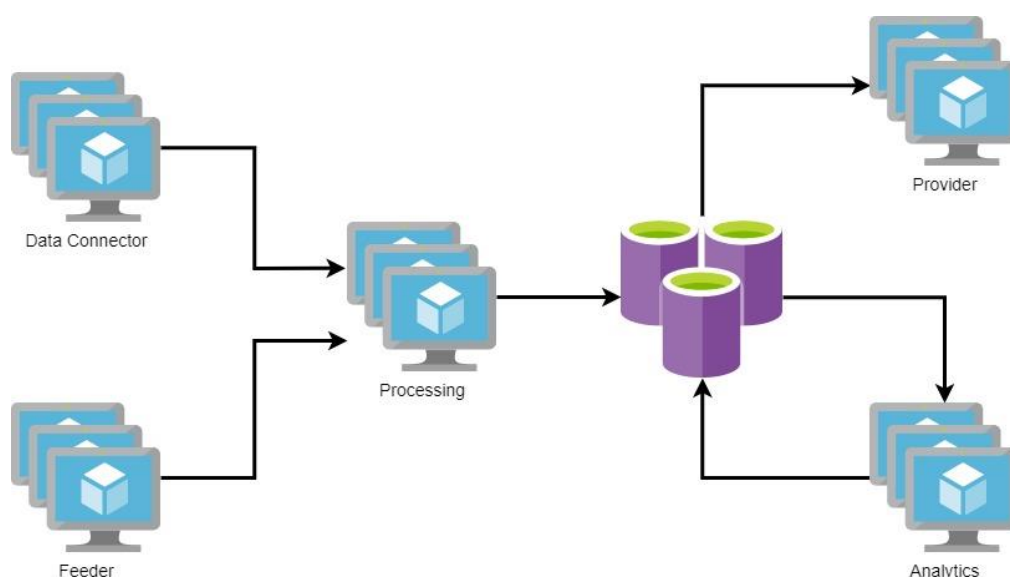


Figure 6: SensLog schema

The SensLog data model draws inspiration from the ISO 19156 Observations and Measurements standard, while incorporating additional extensions. These extensions primarily focus on user management and hierarchical organization within sensor networks.

Adhering to a microservice architecture, SensLog ensures modularity and scalability. Each module functions as an independent microservice, enabling flexible scaling based on specific requirements.

SensLog offers a Representational State Transfer (REST) API that utilizes JSON data encoding in a proprietary format. To enhance interoperability, the platform incorporates a Connector system. Connectors act as intermediary components, translating REST APIs from various data publishers into the SensLog REST API format. SensLog is available under the permissive 3-Clause BSD License.

### 3. CONTENT DATA

There are many types of expert content data of various origin that need to be accommodated on the DALIA KMS. For each type of data, component is prepared. Either text article, spatial data, or web service, all can be integrated and published.

All expert content data fetched within DALIA project and published on DALIA KMS is publicly available within the Open Research Europe initiative, supporting the principle „as open as possible, as closed as necessary“, according to the policy of Horizon Europe programme. Detailed data management plan for DALIA project is available as deliverable D6.1 Data Management Plan.

#### 3.1. Spatial data

The Danube River catchment, encompassing 19 countries across Central and Eastern Europe, presents unique challenges and opportunities in terms of spatial data availability.

The European Union's INSPIRE Directive (Infrastructure for Spatial Information in Europe) plays a critical role in promoting the interoperability of spatial data across member states. It mandates the creation of harmonized datasets for various environmental themes, including water. This directive fosters the development of standardized data formats and discovery services, allowing seamless access to relevant information for the Danube River catchment.

The Water Framework Directive (WFD) emphasizes the importance of good ecological status for European water bodies. It necessitates member states to establish monitoring programs and collect spatial data on water quality, quantity, and ecological health. This data is essential for assessing the current state of the Danube River and its tributaries, identifying pollution sources, and developing targeted River Basin Management Plans (RBMP).

The European Environment Information and Observation Network (EIONET) serves as a vital platform for member states to share environmental data. Through EIONET reporting to the European Environment Agency (EEA), countries



contribute spatial information on water resources within the Danube catchment and make these available using Water Information System for Europe (WISE). This collaborative effort facilitates the creation of comprehensive datasets and supports the development of pan-European environmental assessments.

Next to harmonized EU reporting, there are many national datasets suit to the needs of a given country. These play crucial role for pilot localities, where harmonized EU datasets are either too coarse or do not cover at all the subject of interest of each pilot site.

DALIA KMS is using both EU and national level data to assist in building a better picture of processes and development of the Danube river catchment, EU data is mostly, but not solely, used to bring project wide overview, national data is used to cover pilot sites.

Within the later stage of the project, development of new datasets for pilot sites is foreseen. These would be presented on DALIA KMS as well.

### 3.2. Meteorological data

Meteoblue database was selected as a source of meteorological data due to its excellent coverage of meteorological phenomenon in combination with having everything accessible via well described APIs. **meteoblue Weather APIs** provide access to a vast weather database, allowing users to retrieve and integrate weather and environmental data into their applications. The APIs offer a variety of functionalities:

- **Data Access:** Retrieve historical, current, and forecast weather data, including parameters like temperature, precipitation, wind, humidity, and more.
- **Data Formats:** Access data in various formats like JSON, CSV, and GRIB, ensuring compatibility with different applications.
- **Visualizations:** Integrate ready-to-use weather visualizations like maps and charts directly into applications.
- **Spatial Coverage:** Access weather data for global locations with high resolution.
- **Output Formats:** Choose from various output formats, including raw data and visualizations, to specific needs customization.

#### API Applications:

- **Weather Applications:** Integrate weather data into mobile apps, websites, or weather dashboards.
- **Climate Analysis:** Analyze historical and forecast weather data for climate studies.
- **Renewable Energy Forecasting:** Improve the accuracy of solar and wind energy production forecasts.
- **Smart Building Management:** Optimize building operations based on weather conditions (e.g., heating/cooling systems).

#### Key Features:

- **Large weather database:** Access to one of the world's largest weather databases.
- **High resolution:** Get detailed weather data for specific locations.
- **Variety of data formats:** Choose the format that best suits user needs.
- **Ready-made visualizations:** Integrate weather visualizations directly into user applications.
- **Simple and secure access:** Easy-to-use APIs with secure access mechanisms.

The meteoblue weather APIs offer a comprehensive solution for integrating weather data and visualizations into various applications.

### 3.3. Metadata

Metadata is planned for each map layer published using MICKA metadata catalogue. For the initial DALIA KMS mostly external background data is available and not all layers are equipped with full metadata records. During the continuous update phase of the DALIA KMS, additional maps sources will be added created from proceedings done on pilot sites. First, available legacy data is planned, during the later project phase newly developed map data would be published.

## 4. PILOT SECTION

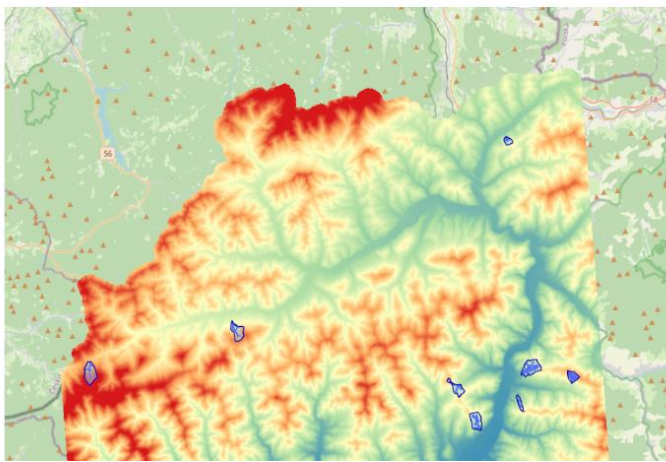
DALIA project includes 9 testing localities within the Danube catchment. Each pilot site has its own dedicated site on the DALIS KMS where all information including maps, graphs, tables, images, data and other resources would be published. Having legacy data published for pilot sites is due in M24 (December 2024) under deliverable D1.3, however we have already started with legacy data implementation on DPS 3 (Thaya River catchment in CZ) and DPS 4 (Upper Váh river area – Kysuca river catchment in SK). For DPS 3 legacy spatial data was already published.

For DPS 4 there was no legacy data available, but new delineation of catchment was done using spatial data analysis tools using GIS modelling above detailed LIDAR based DEM published by the Geodesy, Cartography and Cadastre Authority of the Slovak Republic (ÚGKK). We use DPS 3 and DPS 4 sites on DALIA KMS as a showcase and technology demonstration for remaining DPS, that they can get inspiration and can practically see what is technologically available on the DALIA KMS even for their locality.





## DPS 4: Springs Reborn - Upper Catchment of Váh River Rehydration [SK]



The Demonstrative Pilot Project for the Revival of Springs in the Kysuca catchment aims to:

- Improve the abundance, stability, and robustness of the springs.
- Hydrate the forest.
- Reduce soil erosion by slowing down the runoff of precipitation with close-to-nature water retention measures.
- Prove that rainwater management with rainwater retention measures can regenerate springs and mitigate climate change.

The project will monitor the impact and quantify the effectiveness to allow replication in other areas.

- **Modeling and delineation of 10 micro catchments to monitor the impact of measures taken**

Expected long-term benefits:

- Increased resistance of the micro-region to droughts.
- Reduced risk of flash floods.

Figure 7: DPS 4 site with map application window

Next to map publication, integration of meteoblue data was implemented, using meteoblue API for accessing their extensive archive and web services. For the moment data on average temperature and average precipitation on first two pioneering localities are shown.

### 5. OPEN CALL SECTION

Open call is an important part of the DALIA project aiming at replication of methods carried out in pilot sites to other localities in the countries not participating in DALIA project. Ten associated pilot sites are expected to be selected to replicate one of the available best practices from DALIA project on DALIA KMS. Apart from that, DALIA KMS will act as a technical background for the whole selection process including open call terms publication, proposal upload and announcement of winning proposals. Specialized component will be developed on DALIA KMS to support the open call evaluation workflow that is yet to be defined within task T2.2 that is just about to start in M16 (April 2024).

### 6. FURTHER STEPS

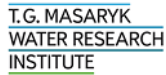


DALIA KMS is continuously developing and alive tool. Its main purpose is to act as a central place for DALIA pilot localities and related activities. Within the initial release the basic set of tools and some first data was published, however the main data publication phase is only starting now.



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# PARTNERS



This project has been funded by the European Union.

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