NET4mPLASTIC PROJECT

WP5 – Act. 5.1 Implementation of the platform (HW, SW) with field and laboratory data

D 5.1.4

Hardware and Network Integration Report

December, 2021 - Version 1.0

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Acronyms / Abbreviations

ACRONYM	DEFINITION
EWS	Early Warning System
MP	Microplastic
OBU	On board Unit
PP	Project Plan
PT	Project team
TC	Technical task coordinator
TGS-ML	Technical Subgroup on Marine litter, European Union expert group On marine litter
TM	Task Manager
UML	Unified Modelling Language
WP	Workpackage

1   Introduction

1.1   Background of the project

The main goal of the NET4mPLASTIC project is to achieve an efficient monitoring system for plastic and MP distribution along the Croatian and Italian coastal and marine areas in order to improve the environmental coastal and marine sea quality conditions.

According to doc R1, the WP5 deals with the design implementation of the EWS - Early Warning System including:

- a control centre, based on system hardware and network (Prosoft), and a EWS application (Hydra Solutions) integrated with the transport model and external systems (such as the oceanographic model - (Marche Region);
- Integrated Marine Drone, for collection of MP - microplastic, and geolocalized water indicators on the route (Hydra Solutions);
- Integrated Marine OBU, a unit to be installed on board of ships for improved MP collection with geolocalized water indicators on the route (Hydra Solutions).

The design shall be carried out with the modern system engineering approach based on UML - Unified Modelling Language (Hydra Solutions). UNITS and RERA SD will provide data for the first set up of the platform related to MP. Based on this WP, the transport model will be developed in WP4. The development of the EWS platform integrated with the transport model will be done in WP5.

The activities planned for WP5 are the following:

- development of the EWS - Early Warning System data center platform and integration with the transport model (WP4)
- development of the UAV/marine drone for real-time data acquisition
- testing and calibration
- business simulation for testing the solution with real users –
- final assessment of the solution, including a CBA–cost benefit analysis and the preparation of the business plan.

The main expected output will be:

- EWS integrated platform, implemented and tested

- Training for the required personnel and users - Assessment of the platform.

The required main software modules of the EWS platform will be:

- MP Transport model, providing data with distribution and concentration,
- MP WebGIS platform, for: a) Display MP data (historical, actual forecast, 24-72h forecast) b) Early warning provision, based on the transport model c) Data entry, recording & replay
- MP DB, the DB for collecting data
- A mobile APP, for starting/closing the field activities and for data reporting
- Firmware for marine remote units - Integration with external system, for meteo/other data

The coordinator will be Hydra Solutions. The EWS SW platform will be developed by Hydra Solutions, with the support of Marche Region for the transport model, and Prosoft for localization, the ICT

implementation, the integrated testing, training and support for maintenance activities. UNITS will coordinate the assessment of the platform. The other partners involved will give contribution for data entry, as target user, and for preparation of the required documentation. The user target group will be based on the main project partners, institution, regions and councils. They will be involved in the design stage for collecting the main needs, for testing and user training of the solution. The target group will be required to use the system during the business simulation, and provide feedback.

The expected reports within WP5 are the following:

- D 5.1.4 –Hardware and Network Integration Report (Report): this deliverable will provide a report with details on integration of the network and other hardware required for the system;
- D 5.1.5 –Test procedures and reporting (Report): this deliverable will provide the procedures for testing the data centre and the integrated solution in the test bed environment, and the reporting of the tests done to assure the quality of the solution provided;
- D 5.1.6 –Hardware & Network Maintenance Manual (Document); this deliverable will provide the manual for the maintenance of the hardware and the network of the system;
- D 5.1.7 –Software User and Maintenance Manual (Document); this deliverable will provide the manual for the maintenance of the software and the User manual for the operators
- D 5.2.4 – Marine OBU / Drone Test Procedure and Report (Document): this deliverable will provide the procedures for testing the drones and the OBU, and the reporting of the tests done to assure the quality of the solution provided;
- D 5.2.5 –Marine OBU / Drone Maintenance Manual (Document); this deliverable will provide the manual for the maintenance of the Drone and OBU;
- D 5.2.6 – Marine OBU / Drone User Manual (Document); this deliverable will provide the User manual for the operators;
- D 5.3.1 – Data Centre Hardware and Network Facility implemented (Hardware, report), in this deliverable is relevant to the implementation of the data centre for the integrated solution, hardware and the network facility, and the preparation of the AS BUILT document describing the data centre facility;
- D 5.3.2 – Remote Units and Data Centre Communication Test Procedure and Report (Document); this deliverable will provide the procedures for testing the communication integration between remote units and the data centre, and the relevant reporting of the tests done to assure the quality of the solution provided;
- D 5.3.3 – Data Centre Test Procedure and Report (Document): this deliverable will provide the procedures for testing the features of the solution provide in the data centre, and the relevant reporting of the tests done to assure the quality of the solution provided, that will be done in cooperation with the main stakeholders;
- D 5.3.4 – Integrated System Final Test Procedure and Report (Document): this deliverable will provide the procedures for the integrated test cases testing the integrated solution, and the relevant reporting of the tests done to assure the quality of the solution provided, that will be done in cooperation with the main stakeholders.
- D 5.4.1 – Training documentation (document): this deliverable is relevant to the implementation of the required documentation for performing training to the personnel involved in the business simulation (as defined in the WP3.3 and the design of the solution);

- D 5.4.2 – Training assessment (report): this deliverable is relevant to the implementation of the training to be done for the personnel involved in the business simulation, with a reporting on evaluation of the training;
- D 5.4.4 – Questionnaire for platform assessment (report) this deliverable is relevant to the preparation of a questionnaire for evaluation of the platform from the user point of view involved in the business simulation;
- D 5.4.5 –Cost Benefits Analysis – CBA of the platform (Document); this deliverable will provide a final document with lessons learnt during the real use of the platform, an evaluation of the benefits of the platform, and costs for full exploitation of the solution, including the future recommendations on potential improvement, and including a business plan for a full implementation of the platform.

1.2   Purpose of the report

This document is the **deliverable D.5.1.4 – Hardware and Network Integration Report**: it provides details on integration of the network and other hardware required for the system.

This deliverable is within the activity 5.1 of the Net4mPlastic project – Implementation of the platform (Hw/Sw) for field and lab data. This activity shall have as input the deliverables of WP3.3 relevant to the design of the solution to proceed with the execution of the following tasks:

- Implementation of custom software modules and data interfaces with existing data modelling software, GIS applications and other commercial software modules;

- Integration and configuration of the Data Centre hardware infrastructure as test bed for the required implementation;

- Implementation of the DataBase;

- Population of the DataBase with existing historical data and new data;

- Installation of the commercial and custom software

- internal testing of the integrated platform.

The coordinator will be Hydra Solutions in cooperation with Prosoft, UNIFE, UNITS, Marche Region. The purpose of this document is summarised as follows:
- Description of the data center hardware
- Description of network facilities
- As built description

1.3   Reference documentation

| No	Title	Rif/Report N.	Pubblished by
[R1]	**APPLICATION FORM - NET4mPLASTIC Project -**	Application ID:	Lead

	New Technologies for macro and Microplastic Detection and Analysis in the Adriatic Basin 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - NET4mPLASTIC Priority Axis:Environment and cultural heritage	10046722, dated 30/06/2017	applicant: UNIVERSITY OF FERRARA
[R2]	D 5.1.5 –Test procedures and reporting (Report)	HYD515-PRO-001.0	ACT5.1 – Net4Mplastic
[R3]	D 5.1.6 –Hardware & Network Maintenance Manual	HYD516-MAN-001.0	ACT5.1 – Net4Mplastic
[R4]	D 5.1.7 –Software User and Maintenance Manual	HYD517-MAN-001.0	ACT5.1 – Net4Mplastic
[R5]	D 5.2.4 – Marine OBU / Drone Test Procedure and Report	HYD524-PRO-001.0	ACT5.2 – Net4Mplastic
[R6]	D 5.2.5 –Marine OBU / Drone Maintenance Manual	HYD525-MAN-001.0	ACT5.2 – Net4Mplastic
[R7]	D 5.2.6 – Marine OBU / Drone User Manual	HYD526-MAN-001.0	ACT5.2 – Net4Mplastic
[R8]	D 3.3.1 – EWS Requirements definitions based on the stakeholders and users' needs, through questionnaires and specific meeting	HYD331-SPE-001.0	ACT3.3 – Net4Mplastic
[R9]	D 3.3.2 – EWS Hardware Architecture and network design (central Data Centre Hardware Architecture Client/Server, Data network architecture and related communication segments)	HYD332-SPE-001.0	ACT3.3 – Net4Mplastic
[R10]	D 3.3.3 – EWS Software Architecture design (data modelling software, GIS applications, early warning detection software, etc.), the Relational Database to manage all collected data with related meta data, the communication Front-End for web remote access, the Data Centre Software Interfaces for users	HYD333-SPE-001.0	ACT3.3 – Net4Mplastic
[R11]	D 3.3.4 – EWS Hardware and other software Components Specifications design (Integrated Marine Drone and Marine OBU, with details of required components (hardware and firmware), firmware and other software components (mobile	HYD334-SPE-001.0	ACT3.3 – Net4Mplastic

	apps for managing the drones and for remote mobile activities).		
[R12]	D 3.3.5 - Report and database provision with all the collected data	HYD335-SPE-001.0	ACT3.3 – Net4Mplastic

2 Data Centre

2.1 Hardware Architecture and Components

The purpose of this paragraph is to describe the integration of the data centre. Herebelow is depicted an architecture/deployment diagram as it has been integrated.
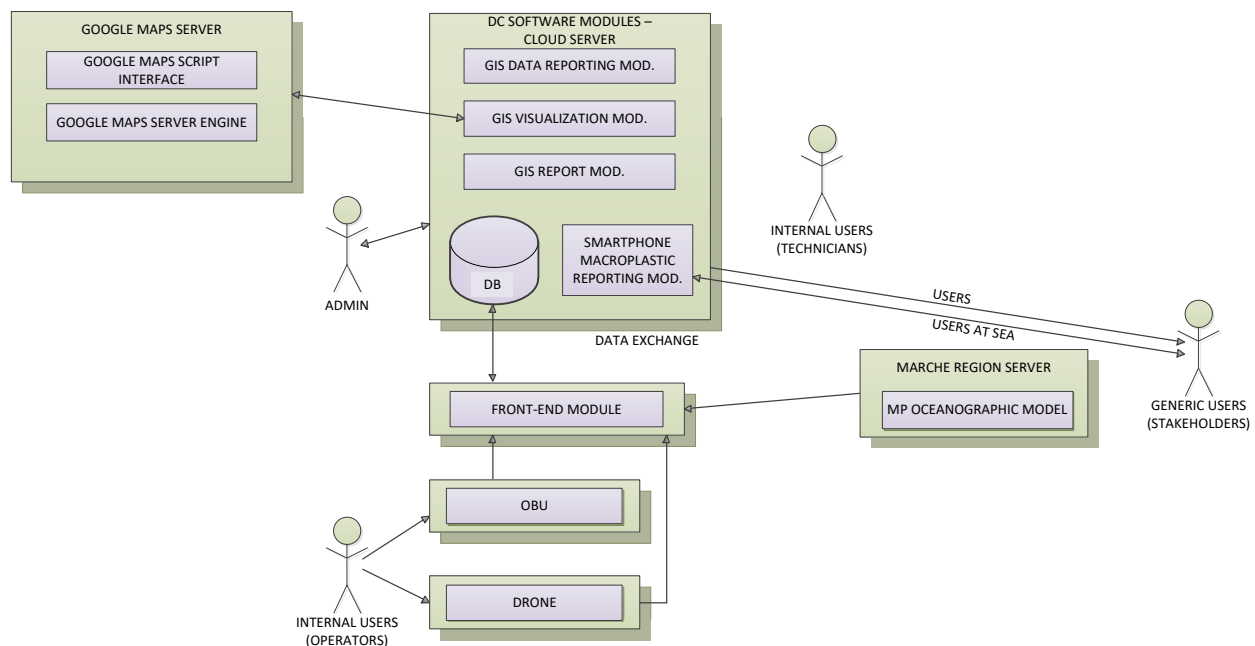
Data Centre Architecture/Deployment Diagram

WebGIS Software modules have been loaded in an on-line data hosting service provider, whileas the oceanographic model runs on Marche Region servers. WebGIS Platform integrates in the hosted space provided all the necessary modules as illustrated in the picture above, such as:

- GIS data reporting module;
- GIS visualization module;
- GIS reporting module;
- Macroplastic SEA SENTINEL viewer;
- - MySQL DB Server for GIS DB.

Thanks to the effort to integrate web-based code such as javascript and PHP it has been possible to integrate the GIS visualization model with the services offered by Google Maps, and create a GIS environment suitable for the purpose of the project, delegating the computational power and storage capacity to the powerful Google Maps.

2.2   Location

All the necessary infrastructures are located on-line on server providers and physically in Marche Region facilities.

2.3   Main Features

Main features offered by the hosting services integrating WebGIS platform are:

- Hosting Linux Apache
- Web-based Administrator control panel
- FTP Access
- Web file manager
- Unlimited third levels (with directory redirect system)
- MySQL database servering
- Private SMTP server
- Guaranteed cybersecurity and antivirus/antimalware
- POP3/IMAP4 access for the integration of the Sea Sentinel macroplastic application
- Hosting Green certified
- Uptime 99,98%

That, integrating with the powerful server computation power of Google Maps, interfaced with its related available API, give a fast response in a Web based environment where otherwise a private server could have required heavier loading times and eventually downtimes, without keeping in account both the huge maintenance costs on the physical hardware and the obsolescence criteria on the medium/long term.

3   Network facility

Networking is also handled server side via Internet. Main data flows are represented in the diagram below.
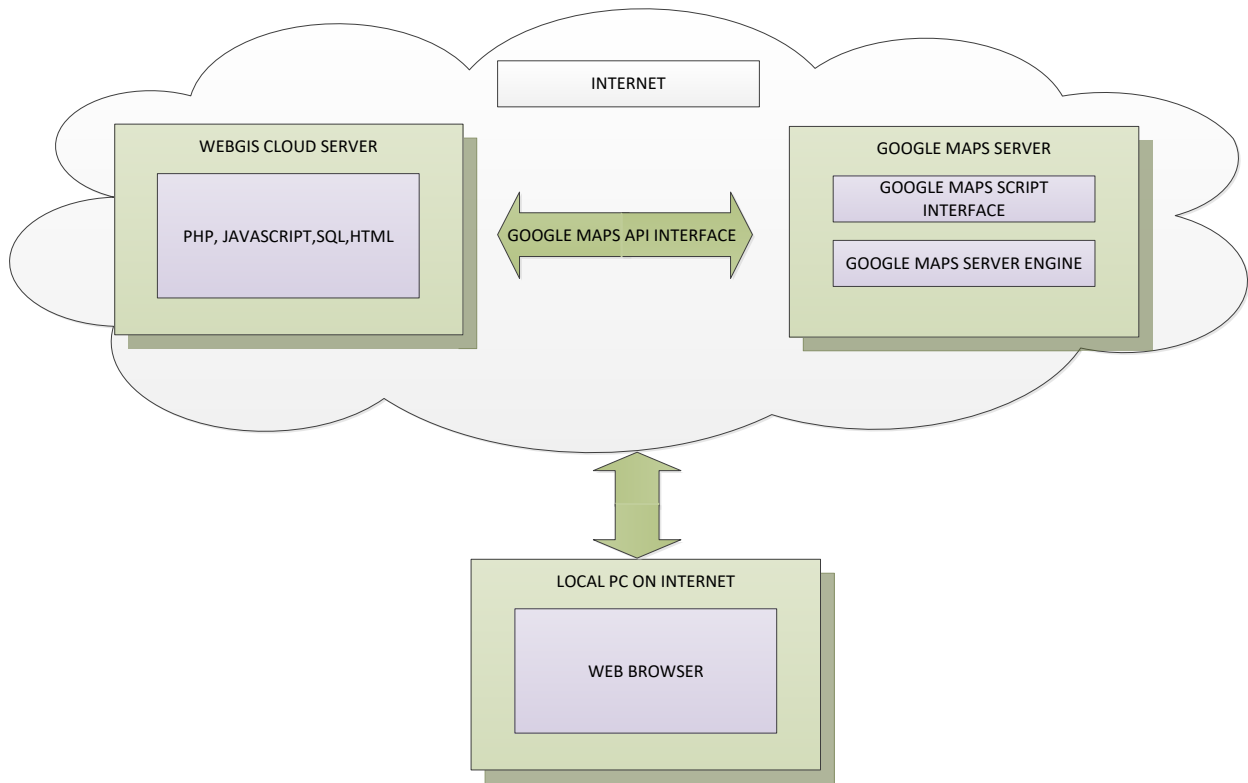
Networking between WebGIS Cloud Server and Google Maps Server

In this case WebGIS platform communicates directly over Internet with Google Maps service , for map retrieving and with its internal scripting code executed by the online remote Apache Server. A simple web browser on a local computer can then navigate over the platform and acquire the desired data.