Introducing the eEnviPer Architecture

January 2013

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1 Executive Summary

Environmental permits are a requirement for many economic activities across Europe, including intensive farming, power stations, waste treatment and manufacturing. However, the permitting process can often be complicated or seem inaccessible to both those implementing the permitting process, and to those seeking to apply for permits.

eEnviPer provides an integrated web-based platform for the application, administration and consultation of environmental permits, making the environmental permitting process more transparent, more accessible and more efficient. Ultimately, eEnviPer will help to reduce the environmental impact of economic activities through the environmental permits process in a cost-effective manner.

The European Union's ICT Policy Support Programme is co-funding the pilot test of the eEnviPer platform in Puglia (Italy), Crete (Greece), Niğde (Turkey), Indjija (Serbia) and Krapina-Zagorje (Croatia). The twelve consortium partners will integrate existing governmental data sources and geographical information systems with Web 2.0 participation platforms and workflow solutions. The resulting single multi-purpose cloud platform will be based on service-oriented architecture and provided as *software as a service* (SaaS). The pilot test phase of the project will be implemented over two years, with the final results expected in March 2014.

Benefits

The eEnviPer platform aims to lower the effort involved in the environmental permits process for both public authorities and for operators: information will be more easily accessible, and defined workflows will increase the speed of the process. After the initial investment to install and customise eEnviPer, the regular cost for the system will be kept low as a result of the cloud-based architecture. Citizens will benefit from the system through the easier means of finding information about current permits and submitting comments and contributions. As compared to existing, mostly paper-based permits processes, eEnviPer offers more benefits for the same price.

Interoperability

Governmental authorities need to combine a variety of databases and workflows to create suitable e-government solutions for their purposes. eEnviPer uses a layered service-oriented architecture to take advantage of existing data sources and complementary environment-related permits systems.

Users

eEnviPer provides digital services for permitting authorities at different levels (local, regional and central). Authorities can then offer access so that:

- Enterprises can manage their own environmental permits application;
- Environmental engineers have access to relevant spatial data and applicable regulations to conduct the environmental impacts assessment; and
- Citizens can provide comments on ongoing application processes online.

2 Functionality and Modules

eEnviPer provides an integrated web-based platform for the application, administration and consultation of environmental permits, making the environmental permitting process more transparent, more accessible and more efficient. Ultimately, eEnviPer will help to reduce the environmental impact of economic activities through the environmental permits process in a cost-effective manner.

The platform integrates existing systems that provide digital services for environmental permits procedures, including:

(i)   Geographic information system (GIS) decision support systems for public authorities;

(ii)   Workflow systems that facilitate the issue and monitoring of environmental permits by providing digital services to enterprises[1];

(iii)   Participatory Web 2.0 platforms that encourage public consultation in environmental issues; and

(iv)   Knowledge management systems (KMS) that empower environmental engineers during the elaboration of environmental impact studies.

Each client installation manages multiple grouped services related with the life cycle of environmental permits. This allows eEnviPer to integrate relevant processes and services for public authorities and agencies. In addition, basic operational services will be offered to citizens as e-services.

The generic operational workflow supported by eEnviPer is presented in figure 1.

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[1] In the course of eEnviPer, (i) and (ii) have been integrated into a single upfront system; however the SOA platform is characterized by a modular approach that supports the interoperability of standalone applications.
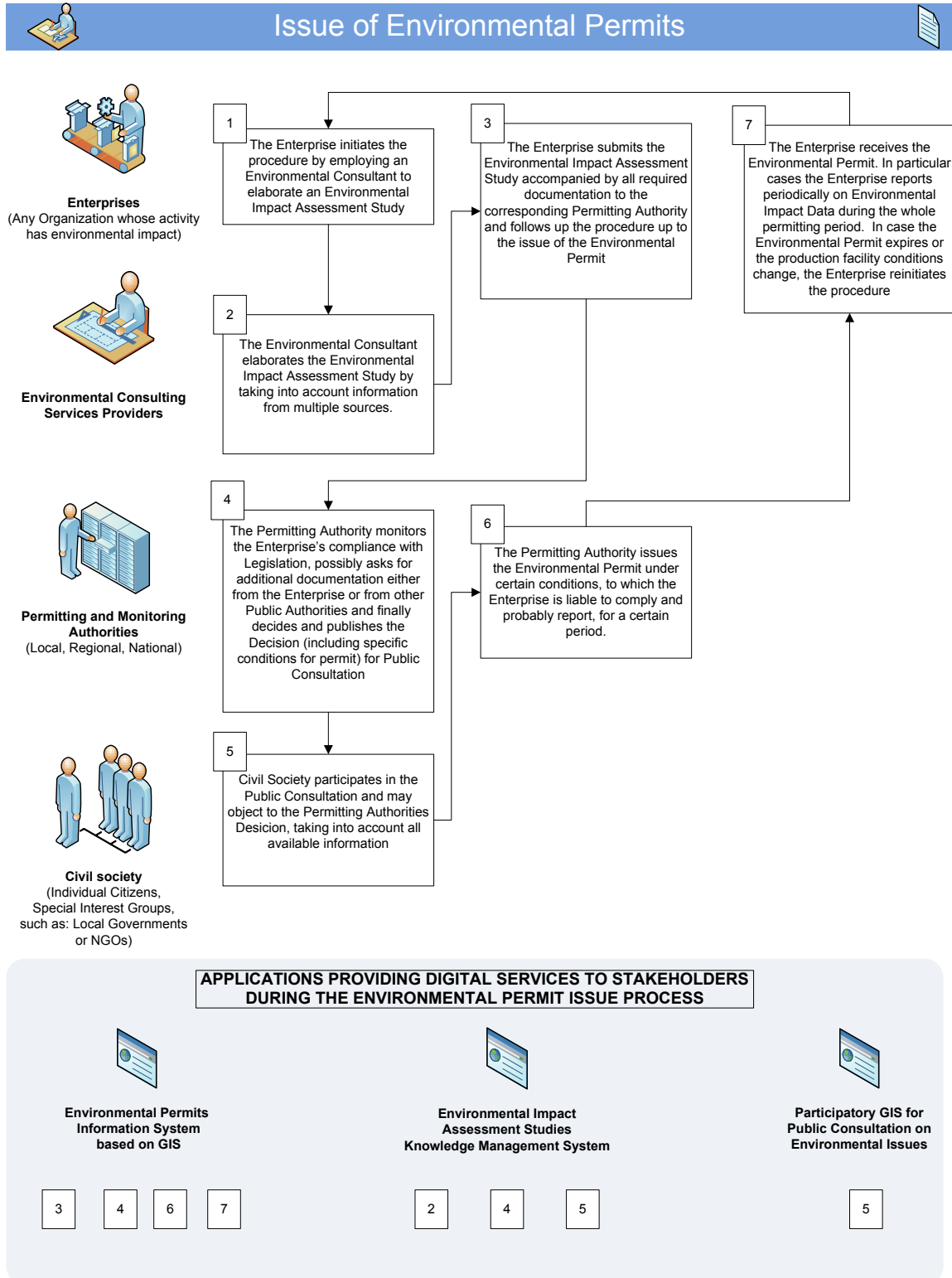
Issue of Environmental Permits

Enterprises
(Any Organization whose activity
has environmental impact)

**Environmental Consulting
Services Providers**

**Permitting and Monitoring
Authorities**
(Local, Regional, National)

Civil society
(Individual Citizens,
Special Interest Groups,
such as: Local Governments
or NGOs)

1
The Enterprise initiates the procedure by employing an Environmental Consultant to elaborate an Environmental Impact Assessment Study

2
The Environmental Consultant elaborates the Environmental Impact Assessment Study by taking into account information from multiple sources.

3
The Enterprise submits the Environmental Impact Assessment Study accompanied by all required documentation to the corresponding Permitting Authority and follows up the procedure up to the issue of the Environmental Permit

7
The Enterprise receives the Environmental Permit. In particular cases the Enterprise reports periodically on Environmental Impact Data during the whole permitting period. In case the Environmental Permit expires or the production facility conditions change, the Enterprise reinitiates the procedure

4
The Permitting Authority monitors the Enterprise's compliance with Legislation, possibly asks for additional documentation either from the Enterprise or from other Public Authorities and finally decides and publishes the Decision (including specific conditions for permit) for Public Consultation

6
The Permitting Authority issues the Environmental Permit under certain conditions, to which the Enterprise is liable to comply and probably report, for a certain period.

5
Civil Society participates in the Public Consultation and may object to the Permitting Authorities Desicion, taking into account all available information

**APPLICATIONS PROVIDING DIGITAL SERVICES TO STAKEHOLDERS
DURING THE ENVIRONMENTAL PERMIT ISSUE PROCESS**

**Environmental Permits
Information System
based on GIS**

| 3 | 4 | 6 | 7 |

**Environmental Impact
Assessment Studies
Knowledge Management System**

| 2 | 4 | 5 |

**Participatory GIS for
Public Consultation on
Environmental Issues**

| 5 |

Figure 1: eEnviPer Workflow

3   Cloud Platform

The eEnviPer platform is offered as a cloud solution, i.e., delivered over the internet and accessible through a secure connection with a web browser.

In the pilot phase, the eEnviPer platform will operate from a server provided by DRAXIS Environmental Technologies in Greece. This server provides the user interface and computation centrally. Ultimately, eEnviPer can be installed on any server fulfilling the system requirements (see below). Where commercial hosts are not an option for security and confidentiality reasons, countries could decide to host a central eEnviPer server for all municipalities and/or a group of permitting authorities could pool together.

The use of an internet-enabled platform such as eEnviPer can be a first step for municipalities and permitting authorities to make their permitting processes more transparent and user-friendly. Depending on the needs of the client, eEnviPer stores data centrally in the cloud, with state-of-the-art security and backup strategies. eEnviPer can also access locally available data sources like GIS information through industry-standard XML-based interfaces.

This approach means that public authorities do not need to purchase additional computer hardware, software licenses or implementation services. This dramatically reduces the cost, and allows for rapid deployment. In addition, the shared use of infrastructure increases the flexibility and scalability of the system and improves the quality of hardware, maintenance and disaster recovery strategies.

4 Service Oriented Architecture

A well-defined service-oriented architecture (SOA) is one of the foundations of eEnviPer. By separating the different functions of the software in layers and clearly defining their interfaces, eEnviPer is flexible enough to work with external applications and data, using structured XML metadata.
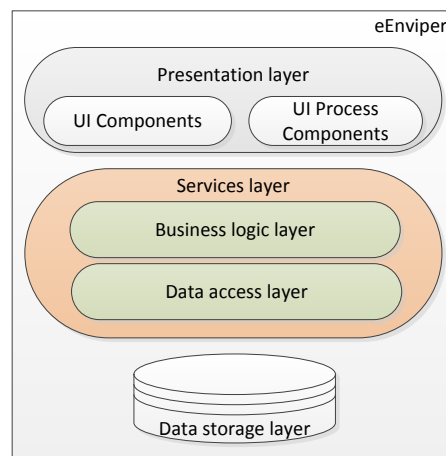

Figure 2 : eEnviPer Architecture

The platform architecture consists of five layers (see figure 2):

1. **Presentation layer**: displays the user interface and manages user interaction. eEnviPer provides two separate presentation layers:
   a. The web application; and
   b. The mobile application.
2. **Data access layer**: provides simplified access to the data and allows for an extra layer of security against threats like SQL or XSS injections.
3. **Business logic layer**: responsible for the entire logic of the system, including the application and monitoring of business rules, the workflows and the validation of data. The business logic consists of several independent components for the specific tasks of the application (see above: Functionality and Modules).
4. **Data storage layer**: responsible for storing and retrieving the actual data in a relational database, text files or other representations (see below: Software Used).
5. **Services layer**: integrates with existing systems that support environment-related permit procedures or GIS layers. The services layer is provided for use by external systems which want to use the data provided by eEnviPer. All services are provided either as REST-ful services (returning JSON or XML) or as RSS (a family of XML-based web feed formats used to publish frequently updated works in a standardized format). The services provided include:

a. Environmental permits to other agencies;
b. Environmental permits to the public;
c. Environmental impact studies to the public;
d. Environmental permits GIS data to national Inspire portals;
e. Environmental impact studies to the public during public consultations;
f. Environmental performance information to the public;
g. Environmental performance information, including inspection results, to other agencies; and
h. Legislation and other documents related to environmental permits to the public.

5   Software Used

eEnviPer builds on DOTFRAMEWORK, a SOA cloud computing platform developed in Greece. DOTFRAMEWORK is based on open source technologies such as PHP, Smarty, jQuery and Ext JS, in order to create a solid and reliable operation platform that would be scalable to fit eEnviPer needs.

Some of the core features of DOTFRAMEWORK, that contribute modules to eEnviPer are:

- DOT WebGIS: a simple online GIS interface to provide geographic information about land use in a certain region. This could include protected areas, existing environmental permits, infrastructure and geographic features. The GIS module then presents geographical data on a map and provides users with a comprehensive tool to interact with.

- DOT MPART: supports e-government and e-participation actions in local governments. It supports online participation and consultation, public discussions, online polls, reliable voting, connections with all social networks and provides mobile support for smartphones (iPhone, android). The MPART modules are used in eEnviPer to collect feedback from the users and to classify their responses to data ontologies.

- Workflow model: to manage flow control within the DOTFRAMEWORK functionalities, in particular validation, assignments and notifications. eEnviPer uses the workflow to handle all the life cycle of the environmental impact assessment processes. From collection of the initial application forms to the final issuing of a decision subsequent to the public consultation phases and experts' evaluation.

- Content management system modules: used in eEnviPer for public authorities to provide updates, articles or knowledge libraries for internal or public use.

- Document management system modules: used in eEnviPer to serve as document repositories that can be retrieved and worked on by any user.

In addition to DOT WebGIS (part of DOTFRAMEWORK), eEnviPer also makes use of the GIS Dashboard based on the ArcGIS server. GIS Dashboard provides a user friendly interface for all spatial datasets. The users are able to locate their area using a map interface, view additional information layers, get information from the map and have access to simple spatial map tools.

6 Integrations and Interoperability

6.1 System Requirements

The DOTFRAMEWORK platform (on which eEnviPer is based) was written in PHP and can be hosted on any server supporting PHP 5.3 or higher. Apache is the recommended web server, but there have also been installations with Internet Information Server. DOTFRAMEWORK can work with MySQL (recommended) and postgres database systems.

GIS server products allow GIS functionality and spatial data to be deployed from a central environment. The eEnviPer platform will use ESRI's ArcGIS Server for spatial data management. ArcGIS Server consists of several components that can be distributed across multiple machines. Each component in the ArcGIS Server system plays a specific role in the process of managing, activating, deactivating, and load balancing the resources that are allocated to a given server object or set of server objects.

6.2 Integrations

eEnviPer can be integrated with existing systems that support environment-related permit procedures or GIS layers and provide digital services for permitting authorities at different levels, enterprises, consulting services and civil society. For the needs of the five pilots that are going to be held of the scope of the eEnviPer project, partners have prioritized the need to fetch data from geographical sources.

eEnviPer supports the following Open Geospatial Consortium (OGC) interoperability standards which can be used when consuming or providing data to other applications:

- OpenGIS® Web Map Service Interface Standard (WMS);
- OpenGIS® Web Feature Service Interface Standard (WFS);
- OpenGIS® Web Coverage Service Interface Standard (WCS); and
- Keyhole Markup Language (KML).

Thanks to eEnviPer's SOA, the platform can act as a data provider to other applications that might need to consume data from eEnviPer. On this basis, eEnviPer can provide digital services for permitting authorities at different levels, enterprises, consulting services and civil society.

Furthermore, SOAP Web Services and REST-ful application programming interfaces (APIs) can be easily configured and made available for almost any part of the data storage layer.

7 Acronyms

API   application programming interface

GIS   geographic information system

ICT   information and communication technology

Inspire   Infrastructure for Spatial Information in the European Community

KML   Keyhole Markup Language

OGC   Open Geospatial Consortium

WCS   OpenGIS® Web Coverage Service Interface Standard

WFS   OpenGIS® Web Feature Service Interface Standard

WMS   OpenGIS® Web Map Service Interface Standard

PHP   Server-side HTML embedded scripting language

Smarty   A library that allows the creation of HTML templates in PHP scripts

jQuery   a multi-browser JavaScript library designed to simplify the client-side scripting of HTML

Ext JS   a JavaScript application framework for building interactive web applications

Postgres   an object-relational database management system(also: PostgreSQL)

MySQL   an open source relational database management system

REST   Representational State Transfer

RSS   a family of XML-based web feed formats used to publish frequently updated works in a standardized format

SaaS   Software as a service

SOA   Service-oriented architecture

SOAP   Simple Object Access Protocol

SQL   a special-purpose programming language designed for managing data in relational database management systems

XSS   Cross-site scripting

XML   Extensible Markup Language