European conference of the Czech Presidency of the Council of the EU
TOWARDS eENVIRONMENT
Opportunities of SEIS and SISE: Integrating Environmental Knowledge in Europe
http:/www.e-envi2009.org/proceedings/
J. Hřebíček, J. Hradec, E. Pelikán, O. Mírovský, W. Pillmann, I.Holoubek, T. Bandholtz (eds.)
Masaryk University, 2009

Localised environmental and health information services (lenvis): a generic Decision Support Network

S. Loos[a], **A.H. Lobbrecht**[a]
[a] *HydroLogic BV, P.O. box 2177, 3800 CD Amersfoort, The Netherlands*
www.hydrologic.com

Abstract: There is a growing demand for real time and integrated environmental and health risk information. Provision of location-based services linked to the state of the environment at particular geographical locations is necessary for improving the quality of life. This is essential for mitigation of environmental-related health threats associated to water quantity and quality, and outdoor air pollution. The main goal of the lenvis project is to develop an innovative collaborative decision support network for exchange of location-based environmental and health services between stakeholders. Lenvis includes health indicators as integral part of the environmental management. Lenvis furthermore aims at supporting governments in communication with the general public and in particular to address the young generation Y, by entering popular digital information sources and social networks. This is done by development of a generic ICT solution on the basis of service-oriented-architecture (SOA), providing data, information and modelling services. The approach will be validated through test cases on surface water and outdoor air quality in the Netherlands, Portugal and Italy. Lenvis facilitates collaboration between different stakeholders, such as environmental protection agencies, health institutions and service providers, policy makers, citizens in general and environmental communities in Europe.
This paper presents the first ideas of the lenvis project which started in September 2008, specific technologies presented are subject to change during the project.

Keywords: Environmental information; Service Oriented Architecture; SOA; collaboration; water quantity; water quality; air quality; health indicator; monitoring; modelling; decision support.

1. INTRODUCTION

Human health and environmental quality are closely linked. Environmental pollution and in general poor environmental quality have well-established effects on human health and the quality of life. This increases the demand for real time and integrated environmental and health risk information. The lenvis project will integrate environmental and health information in the steps of identification and assessment of impacts, decision making and recommendations, having atmospheric pollution and water pollution as the risk factors for human health and creating a novel decision support network, capable to support stakeholders and citizens in their activities.

1.1 The lenvis goal

The overall goal of lenvis is to develop and validate an innovative collaborative decision support network (DSN) for exchange of location-based environmental and health services between stakeholders, for enhanced capacity to assess population exposure and health risks.

This network will specifically target European citizens and in particular the upcoming young generation-Y.
The lenvis project aims to fill the existing gap between environmental management and health management systems. This will be done by developing a generic ICT solution that combines service-oriented architecture (SOA) and user-centric approach by fusion of location-based environmental and health data, information and modelling services. This novel collaborative network is validated through test cases on fresh surface water and outdoor air quality in the Netherlands, Portugal and Italy. Lenvis also aims at bridging the socio-technology gap between the authorities / policy makers and the general public. This is achieved by use of communication channels appropriate to the upcoming generation-Y, using converged communications over IP as the basis of collaborative services and broadcasting capabilities. This young generation is branded as strongly decentralised and anarchistic users who, on a daily basis, use the modern information and communication technologies, such as collaborative networks for sharing ideas, opinions, data files, video, music, e.g. YouTube, MySpace, Hi5, FaceBook and others. Various media and technologies are being used for this purpose e.g. blogs, podcasts, P2P sharing, and highly personalised websites.

2. LENVIS NETWORK

2.1 Introduction

The lenvis project aims at research and development of an architecture and technical solution for integration of services, linking water, air and health domains, providing information through a user centric decision support network.
Through the development and integration of novel ICT solution it combines (Figure 1):

- SOA architecture, enabling collaborative services and a more efficient fusion of environmental data and modelling services and health risk assessment indicators. These components are termed as Service Provider Peers (SPP);
- Collaborative environment, facilitating collaboration between the end-users, in particular the EU citizens. These components are termed as User Peers (UP);
- The network management component, in order to assure the quality and security of the data and information provision on the lenvis network. These components are termed as Network Management Peers (NMP).

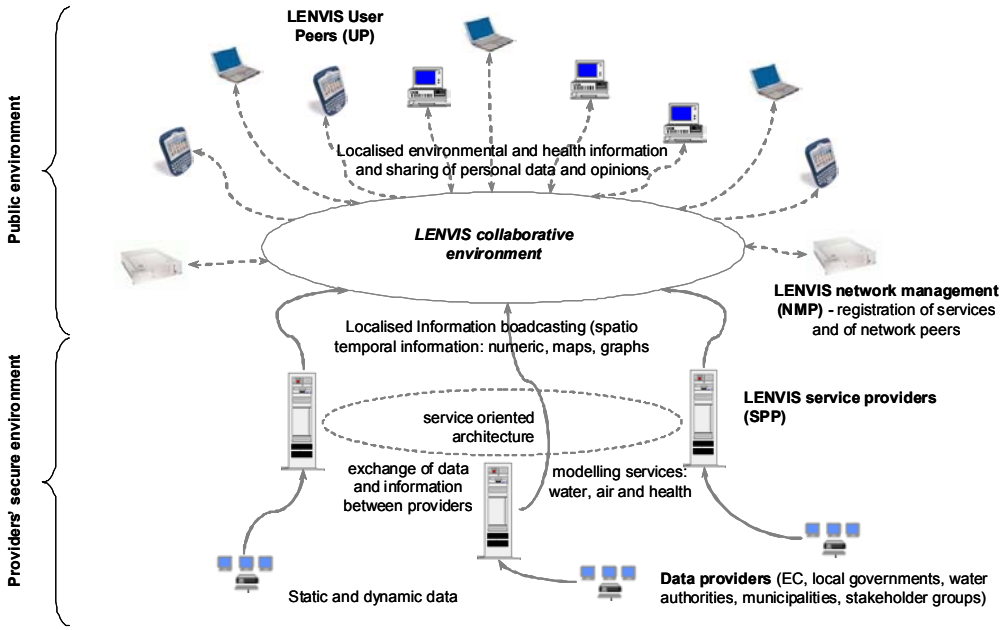

Figure 1. Schematic representation of the lenvis concept.

2.2 Service Provider Peers

The SPP is a generic environmental service provider. Each SPP provide one or more services and the interface to the service bus. A service repository contains the descriptions of the services. Environmental service providers register their services in this repository and service consumers access the repository to discover the services being provided. All SPPs cooperate according to a SOA approach. The SPP data providers can provide quality labelled data, connections to sensor networks and telemetry data, or they can combine services from other lenvis and non lenvis service providers (e.g. meteorological and geo services, Google map services, etc.).
Lenvis SPPs will also provide domain related modelling services, in the framework of the SOA architecture. Advanced environmental modelling systems for a regional scale as well as a local scale are used, e.g. MM5, CHIMERE, MOHID, and HydroNET. These systems are used together with health modelling algorithms to be developed and will be available as services in lenvis for an integrated assessment of air quality, water quality and the related health impact.

2.3 User Peers and Network Management Peers

The User Peers (UP) create the basis of the collaborative network. The main goal of this socio-technical network is to facilitate exchange of environmental and health-related data, information, feedback, analysis, models, documents, multimedia and other information between the stakeholders and EU citizens on a certain geographical location and about certain catchments, urban area or ecosystem. The UPs will run as a lenvis desktop application, a web portal and as light clients on semantic-enabled mobile devices (e.g. PDAs, cell phones, laptops). Key functionalities of the UPs are:

- graphical display of geo-temporal data in thematic maps: water quality for bathing, air quality levels health risk indicators e.g. for asthma patients.
- sharing of data and information, feedback and opinions;
- initiating polls and public opinions;
- collaboration facilities with other peers on the network.

The NMP provides the link between the first two components. The key real-time functionalities of NMPs are registration of all peers on the network, registration of available services on the network, user profiles management, management of meta information (dynamic) and routing of users.

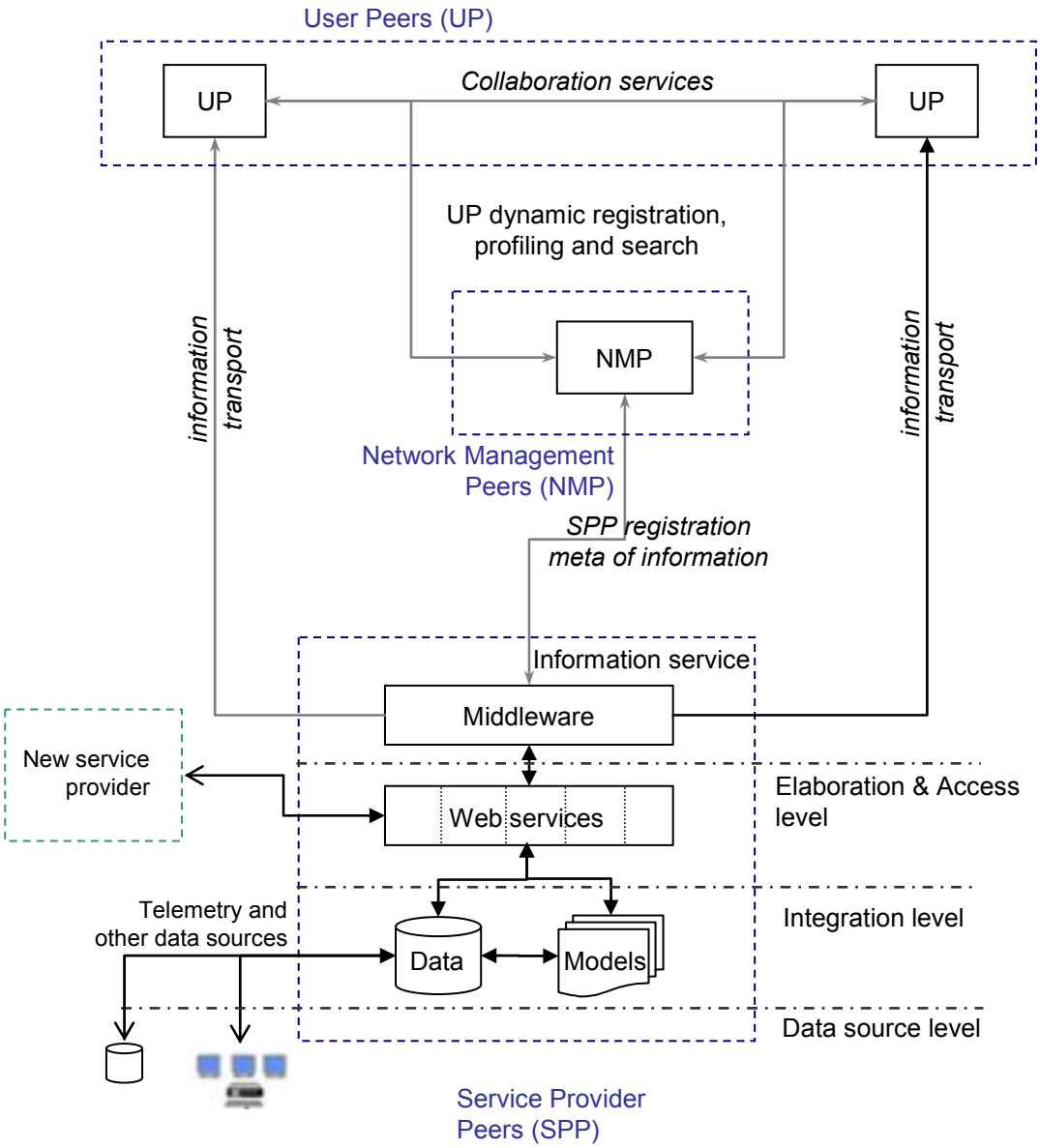

Figure 2. Logical architecture of the lenvis system.

3. CASE STUDIES

Lenvis, being an ICT project focused on developing novel applications for environmental management, will be validated in three case studies in those areas where epidemiological studies are already available: air pollution in urban areas (cardiovascular, respiratory diseases) and water pollution in rivers and estuarine areas (gastrointestinal and respiratory diseases).

3.1 Italy: Air and health

The objective for the case study in Italy is to use air quality monitoring and prediction and health services for the urban areas of Milan and Bari to analyse relationships between air pollution and health risks, to evaluate air quality management strategies for their effectiveness, and to forecast air quality conditions and probable effect on health. As air

pollution is becoming a 'hot topic' among citizens and especially among young people (school and media are dedicating more and more space to this theme) a further goal of the case studies in Italy is to experiment how the availability of information will increase the awareness on this critical issue. The end-users are the University of Milan, the Municipality of Bari and the citizens of these urban areas.

3.2 Portugal: Water and health

The Portuguese case study area is the Lisbon coastal region, which presents extensive bathing areas in both the north and south banks separated by the Tagus estuary. All beaches are usually good for bathing and frequently visited by the inhabitants of Lisbon and foreign tourists, especially during the summer months. In the last decade there has been a great effort in the identification and eradication of point sources along the coast, but diffuse sources of faecal contamination associated to watersheds remain a problem. As a consequence, occasionally faecal pollution of the bathing waters posses a health risk. Since it is impossible to control all diffuse sources of faecal pollution in heavily populated areas (context for the Bathing Water Directive 2006/7/EC) an information system needs to be established that is able to alert the public and authorities for water quality problems. Lenvis will contribute to this objective addressing the current lack of integrated water quality predictive capacity and appropriate data management and dissemination systems by applying modelling services on existing watershed models and meteorological models. The lenvis system will be used to manage all the real-time monitoring and modelling data streams and to interact with the end-users on the basis of health risk alerts. The end-users are the water utility company (Sanest), the Portuguese National Health Service, and the visitors / recreational users of the beaches.

3.3 The Netherlands: Water, air and health.

The Dutch case study takes place in the Province of Noord-Brabant The province counts almost 2.5 million inhabitants, of which by far the most live in urban areas. In between the cities, there are numerous recreational lakes that are used intensively during summer. Both the air quality in the province and the bathing water quality of the lakes sometimes drops below health risk thresholds. The bathing water quality is mainly threatened by algae and external inflow of polluted water. The algae concentration is monitored by a number of point measurements in some of the lakes. The monitoring of water quality of the connected canals and streams is limited and the progression towards the bathing water is not modelled. High waters impose risks to the area as well as may be damaging the existing natures. Flood damage prevention projects have been carried out to research this. Alerts on high waters are the responsibility of the local waterboards, which take care of water quantity and water quality control. The air quality has strongly improved over de past 10 years, but still not all concentrations of substances are meeting the European thresholds. An air quality monitoring and information system is proposed to help to decide on measures to further improve the air quality, and a meteorological forecasting system to provide longer warning times in case of calamities. Lenvis addresses the need for modelling of both water quantity/quality and air quality and the subsequent health risks to provide timely warnings to the end-users in these three domains. HydroNET software provides the required data services for handling meteorological data and forecasts. Online modelling services will be used for hydrological, hydrodynamic and water quality modelling. The end-users are: the Province of Noord-Brabant, the waterboards, representatives of stakeholder groups (nature, recreation, etc) and the citizens.

4. VALIDATION AND TESTING

The validation and testing of the lenvis DSN is divided into two programmes. The first is the technical, functional testing of the system. The second is the end-user validation of the system. In the functional testing, the data and modelling service providers are involved.

Each component, e.g. real-time data delivery and environmental and health models, are first tested separately by the individual provider for each case study, and then in the integrated system. The functional testing of the lenvis DSN is lead by the individual developers of services and is also performed for each case study.

From this point onward the end-user validation starts. Here still functional properties will be incorporated, such as reliability and robustness of the system, however, emphasis is on getting the end-users experiences when using the lenvis DSN in (near) real-life situation testing. Different aspects such as accuracy of the information, availability of the information, relevance of the information, interpretability of the information and user friendliness of the system (software and hardware) will be assessed. Small dedicated user groups are being selected. They will include persons from organisations involved as end users, and a number of citizens. The citizens will interactively report, through a predefined format, on how the warnings through the system (would have) affected their actions.

5. ACKNOWLEDGEMENTS

The lenvis project is part of the FP7 ICT - Information and Communication Technologies Work Program, Challenge 6: ICT for Mobility, Environmental Sustainability and Energy Efficiency.
Involved partners are: HydroLogic (NL), UNESCO-IHE (NL), Project Automation (IT), Technical University of Lisbon - IST (PT), Aria Technologies (FR), EsaProjekt (PL), University of Milano Bicocca (IT), Hidromod (PT), Province of Noord-Brabant (NL) and Municipality of Bari (IT). More information on this collaborative project as well as the partners involved can be found on: www.lenvis.eu.

6. CONCLUSIONS

The main goal of the lenvis project is to develop an innovative collaborative decision support network for exchange of location-based environmental and health services between stakeholders. This is done by developing a generic ICT solution that combines service-oriented-architecture (SOA) and user-centric approach (collaborative network). Air and water data and models are integrated in a SOA architecture, to be available as services for environmental management. These will provide meteorological, air and water quality information at specific geographical location. Health indicators are included on top of these data streams. Lenvis aims at supporting governments in communicating environmental and health information with the general public. In particular it addresses the young generation Y, by entering popular digital social networks and providing the information in popular interfaces such as collaborative websites and on mobile devices such as mobile phones and PDAs.