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e-collaboration Platform for the Development of Rural Areas and Enterprises

Grzego rz Kołaczek
Wrocław University of Technology, Wrocław, Poland
Email: grzegorz.kolaczek@pwr.wroc.pl

Adam Turowiec[1,2],
Dominik Kasprzak[1]
[1]ITTI Sp. z o.o., Poznań
[2]AMI@Work Family of Communities
Email: {adam.turowiec,dominik.kasprzak}@itti.com.pl

Witold Hołubowicz
Department of Applied Informatics
Adam Mickiewicz University,
Poznań, Poland
Email:holub@amu.edu.pl

***Abstract*—This paper presents the basic assumptions of the Collaboration@Rural project (C@R) supported by the EU's 6th Framework Programme for Research and Technological Development. Apart from discussing primary objectives of the project—focused on supporting the development of rural areas by providing network-based collaboration environment—it also shows basic assumptions of a 3-layer reference model serving as the foundation for C@R architecture. As an example of service rendered available within such network collaboration environment, the implementation of a notification service component is presented herein.**

I. Introduction

Accounting for more than 90 percent of the EU's territory, rural areas are inhabited by almost 60 percent of its population. For this reason, the development of rural areas has long been one of the major priorities of EU's policy [5]. Despite that, many of those areas are still challenged by serious problems.

In the world of globalisation, dynamic competition and free-market economy, agriculture and forestry-related enterprises must continue to improve their competitiveness. What is a serious issue in this context, the average income per capita in rural areas is usually lower compared with cities, skills resources being lower as well, and the services sector—poorly developed. Nevertheless, rural areas have much to offer too. First and foremost, they are the source of basic raw materials. Because of the natural resources they are also a valuable place of rest and recreation. Many people are considering living or working in the country, as long as they can count on access to proper services and infrastructure (including ICT infrastructure). Bearing the above in mind, the objective of EU's policy relating to the development of rural areas is to overcome the challenges facing the population of such areas, and to utilise their potential [5, 6].

Chapter 2 of this paper presents a general concept behind the Collaboration@Rural project, together with its main objectives. Chapter 3 contains the characteristics of a layer-structured reference model of C@R architecture, while the next one describes the concept of implementing the e-mail based notification service within the framework of this project. The final chapter contains a summary and some information about the policies of further actions.

II. Objectives of the Collaboration@Rural project

Collaboration@Rural[1] project (C@R) is a 3-year-long project carried out since September 2006 as part of the EU's 6th Framework Programme for Research and Technological Development. The project is being implemented by a multinational consortium comprising over 30 partners—universities and research centres, companies (both market leaders like Nokia or SAP, and representatives of the SME sector) and international organisations (including FAO and ESA). Poland is represented by Adam Mickiewicz University from Poznań.

The goal of this project is to accelerate the implementation of Collaborative Working Environments (CWE) in the context of sustainable development of rural areas. According to this concept, C@R encompasses a number of R&D actions (from analyses to validations), which have been grouped in three major interest areas, also defining the framework of technical solution—C@R service architecture (layers): Collaborative Core Services (CCS), Software Collaborative Tools (SCT) and Living Labs (see 1).

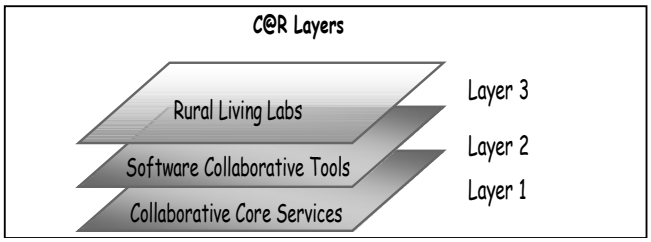

Fig. 1 C@R Architecture

C@R project implementation aims to complete five basic objectives, which have been defined in the following way [3]:

[1] Full title: „*A collaborative platform for working and living in rural areas*"

Obj 1: C@R will deliver collaboration environments to rural communities, to be defined in relation with the remaining network collaboration environments (CWE)

Obj 2: C@R will present the method in which three types of users can utilise the shared platform that integrates various hardware and software tools

Obj 3: C@R will promote the use of Open Collaborative Architecture (OCA) to cater for the needs of implementing new industrial and business projects in the rural sector, at the same time showing its usability and suitability for this type of actions

Obj 4: C@R will develop a concise methodology serving the development and assessment of obtained Rural Living Lab results

Obj 5: C@R will provide support to policy makers in the context of designing new strategies of development and innovation for rural areas after 2010.

III. Layer-Based Reference Model for ICT Collaborative Environment

IT tools and technologies supporting group work and facilitating the creation of network collaboration environments (both for individual and group entities) have been the subject of studies, analyses and numerous research papers in the recent years. Owing to the continuous development and spread of technologies improving the efficiency of use of IT tools, it has lately become possible to carry out many specialist tasks (e.g. real-time positioning, teleconferences, telework, mobile workers' support, etc.) and reach communities that used to be marginalised (living in sparsely populated areas, rural areas, etc.)

The following 3-layer reference model has been approved for C@R, serving as the basis for the creation of an ICT collaboration environment for rural areas, comprising (see Fig. 2):

- Collaborative Core Services (CCS)—layer 1;
- Software Collaborative Tools (SCT)—layer 2;
- Rural Living Labs (RLL)—layer 3.

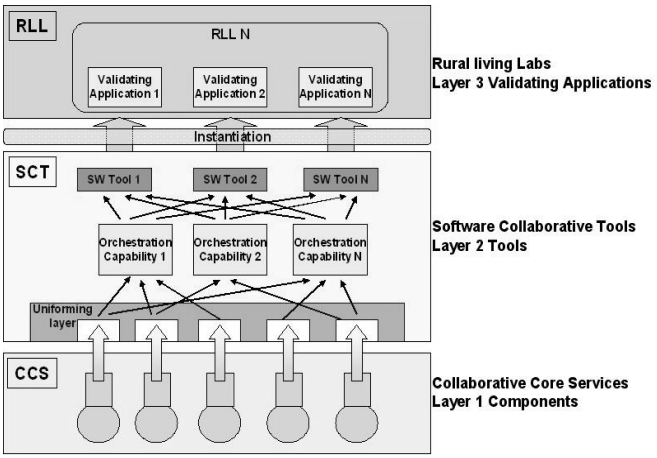

Fig. 2 Layered reference model for C@R [3]

The CCS layer includes software modules that allow to use all key platform services and resources (e.g. networks, sensors, devices, etc.). These modules can be freely combined with one another, and utilised with layer 2 SCT tools. With such flexibility, the C@R service architecture will be capable of cooperating with any solution and tool from outside the scope of the project (irrespective of its openness), which will allow the project to contribute significantly to defining the concept of Open Collaborative Architecture (OCA). The third layer—Living Labs—will render real environments available for the purposes of developing and validating solutions meeting specific needs of users from rural areas.

I. Collaborative Core Services Layer

The layer of collaborative core services (CCS) is the first one in the 3-layer C@R reference model. It focuses on basic or low-level services and resources, which are indispensable for building a collaborative working environment (CWE). Consequently, elements of this layer comprise all mechanisms and technical means allowing to e.g.: provide access to ICT network, use advanced network services, render subject location service available, use the geographical information system, provide notification services and web services, deliver dispersed processing environment, etc.

All services available in this layer should be encapsulated in single programme components (CCS components) with specific objects defining data, protocols and API interface, so that they can form the basis for the structure of more complex services at the second layer of the model (comp. Fig.3).

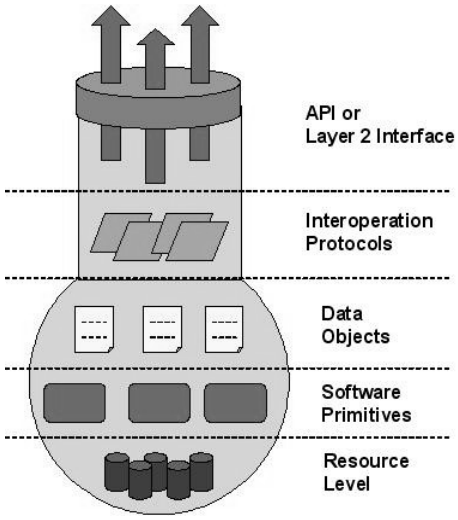

Fig. 3 CCS component construction [3]

The following CCS component classes have been defined in the C@R project:

- communications—comprising:
  - all possible network access systems (WiFi, WiMAX, UMTS, etc.);
  - advanced network services (QoS, multicast, etc.);
  - advanced services available via signal protocols (SIP/IMS, forwarding, multimodality, etc.);
- related to environmental and context data capture :
  - ICT infrastructure and devices (GSM/GPRS, GPS/Galieo, positioning services, terminals, etc.);

- sensors and sensor networks providing data on environment variables, and allowing to identify subjects (e.g. data from RFID sensors required to identify goods, animals, etc.);
- biometric devices and protocols (advanced methods of subject verification based on individual characteristics of eye retina, fingerprints, voice recognition, etc.);

- related to user experience :
  - all elements used directly by parties cooperating in rural areas, e.g. advanced graphic interfaces, computers built into tools, wardrobes, etc.;
- related to informati—on management:
  - all information sources;
  - data repositories—also dispersed ones;
  - data access technologies;
  - notification services;
  - web services.

II.Software Collaborative Tools Layer

The second layer—Software Collaborative Tools (SCT)—is responsible for delivering the following three functionalities:

- Uniforming Middleware:
  it is a conceptual middle layer for CCS components, its goal being to harmonise, unify and adapt to existing standards; with this functionality, the C@R architecture gains flexibility and power, owing to improved integration with existing and newly developed standards;
- Orchestration Capabilities:
  this layer is responsible for delivering—within the network collaboration environment (CWE)—complex services, such as dispersed working environment, conditioning action and context; implementation of this objective consists in delivering mechanisms that allow to integrate elementary CCS components into more complex elements; key research issues relating to this functionality revolve around such elements as ontologies for collaboration environments, semantic compatibility, flows, synchronisation and coordination of middleware;
- Software Tools:
  they contain all necessary software components (scripts, programmes, intelligent agent programmes) in order to supply the end user with a component able to deliver specific services; basic components are related with synchronisation protocols, middleware orchestration protocols, dispersed repositories, context identification, multimodal interfaces and security.

III.Validation layer—Living Labs

The concept behind a *Living Lab* is a methodology of conducting research and implementation activities in Knowledge-Based Economy and Information-Based Society conditions, where innovative products, services or applications are designed, tested and improved in real conditions, in interdisciplinary teams comprising all interested entities—from engineers and researchers, through entrepreneurs, local authorities and social organisations, to citizens.

A Living Lab is also a place (usually some area of a town, university campus, technology park, etc.) where innovation is developed—not merely in terms of technology, but also society, economy, etc.—focusing on the needs of the recipient. This unique anthropocentrism relating to the method of conducting research—i.e. focusing on people (citizens) as well as their requirements and expectations—is a characteristic feature of Living Labs methodology: man is the source of innovation here rather than the subject of testing, or the source of feedback needed to improve products. Moreover, the process of creating innovation is open [1,2] (i.e. based on a broad partnership of many different organisations) and democratic [4] (i.e. involving entire communities of end users). What is also important, each Living Lab is based on the collaboration of players of key importance to a given region (including local administration), owing to which it can engage in the completion of the strategic goals more efficiently.

The concept of Living Labs (LL) was developed within the framework of *AMI@Work Family of Communities* [7], the international expert group closely cooperating with the European Commission since 2004. Beginning from the Finnish Presidency (end of 2006) regions, cities and organisations which develop their own Living Labs (more than 50 currently) have been associated in the European ENoLL network (*European Network of Living Labs*). EnoLL, together with a number of projects co-financed by the European Commission (i.e. C@R accompanied by CoreLabs, CLOCK, COLLABS and others), have provided the background for creating numerous tools, guidelines and procedures aimed to facilitate developing and supporting the operation of Living Labs. Besides receiving support from the European Commission, this initiative has been supported by successive EU Presidencies and particular regions.

The role of Rural Living Labs (RLL) in the third layer of the C@R model consists in activating the Collaborative Working Environment—not merely in the final stage, being the validation of designed solutions, but also at the research level, e.g. when domain ontologies are being developed. C@R project entails continuous active involvement of RLL community members who are to be an important source of information about the accuracy of courses of research undertaken in each of the middle stages of the project, or allow to estimate the effectiveness of approved solutions at the level of individual system components. Another key role of RLL's is their social dimension, namely they allow to monitor social reception on an ongoing basis, along with the effectiveness of utilising proposed solutions.

Consequently, the third layer of this model is responsible for implementing the following tasks:

- causing a Collaborative Working Environment to acquire specific characteristics required by each of the RLL labs;
- selecting appropriate infrastructure or adapting existing infrastructure to each RLL, allowing to fully utilise the capabilities of lower layers;

- designing appropriate applications adjusted to specific needs and activities of each RLL;
- implementing a validation process based on action scenarios existing in each RLL, along with typical users' activity, in order to supply feedback to the designers of layer 1 and 2 components.

IV. An Exemplary Implementation of the CCS Component—a Notification Service Based on Electronic Mail

One of the benefits notification services offer to entrepreneurs is the possibility of an immediate transfer of almost any information to a defined group of registered users. In particular, the entrepreneur or business partner is able to transfer their messages to cooperators and customers in the natural course. What is important is the fact that messages can be addressed to a selected group of recipients; thus, their content may be personalized and suited to the relation binding the entities, as well as to current needs.

Most entrepreneurs have already appreciated the benefits offered by this type of services and use them actively. Nevertheless, the fact remains that the solutions available today are characterized by a number of problems limiting the potential scope of their application. Among the commonly noticed drawbacks of the available solutions are: limited scanning possibilities, high dependence on the equipment and program platform, limited possibilities of configuration and management.

For these reasons, a CCS component allowing any entity reporting such functionality needs to benefit from the advantages of notification services is to be developed within the C@R project.

In order to demonstrate the possibilities of creating notification services integrated with the C@R platform, an SMTP-CCS component, allowing for sending e-mails, was developed. Its main element is the CCS, containing a Server capable of sending SMTP messages to an e-mail Server. The service provided by the SMTP-CCS component is available through the *Web Service* interface.

In order to take advantage of the possibilities offered by SMTP-CCS and the C@R platform, a client component needs to be implemented, which would enable access to the provided service.

IV.Resources included in the component

The following resources were included in the components in order to create the notification service:

- SMTP-CCS contains a server capable of sending SMTP messages to an appropriate e-mail server; this server and the component are located in the same local network, thus facilitating communication. CCS makes the Web Service which allows for sending messages, available to the world (SendEmail);
- Client CCS contains a simple text interface enabling registration on the platform and the sending of basic e-mail messages with the use o the service provided by SMTP-CCS.

V. Component Specification

- The server

The purpose of the SMTP-CCS component is to mediate between different C@R platform elements and the electronic mail server sending e-mail messages. The server is an element passively awaiting customer demands, which are serviced as they are sent.

The component implements the following functions:

- Web Service client, which enables registration on the platform;
- Web Service interface, which allows for obtaining connections with other elements of the platform;
- Web Service interface which enables the reception of demands for a notification email.

- The client

The client component is an active element, which establishes connections with the server component for the purpose of sending notifications.

- The component implements the following functions:
- Web Sernice client which enables registration on the platform;
- Web Sernice interface which allows for obtaining connections with other elements of the platform;
- Web Sernice client which allows for sending connection demands to a different component;
- A client servicing the data channel (it this particular case Web Service) which enables the sending of a notification through SMTP-CCS.

VI. The integration of the notification service with the C@R platform.

In order to integrate the notification service with the platform, the following steps were taken:

The CCS core was fed with appropriate data enabling registration; “Notify e-mail” was indicated as the name of the provided service, being an available “WebService.SendEmail” data channel;

- The component’s Specific Options service was complemented with the necessary parameter of Web Service SendEmail address;
- The SendEmail service, which processes data, was implemented
- The SMTP-messages-generating functions were implemented;

In order to integrate the service client with the platform, the following steps were taken:

- CCS component framework was fed with the appropriate data enabling registration;
- The notification service search criteria were set for “e-mail”,
- A simple text interface allowing for testing client’s operations was implemented.

VII. Component interactions

Figure 4. demonstrates the way in which components communicate. The sending of a notification entails realization of the four following stages:

1. The client component registers on the platform and sends an inquiry for availability of the server component (SMTP-CCS) and access parameters (protocol, address, etc.)
2. The client prepares a message including information describing the e-mail to be sent for SMTP-CSS. Once the message has been prepared, a suitable Web Service is called up (in this particular case SendEmail).
3. The SMTP-CCS server prepares and sends the SMTP message to the e-mail server.
4. The e-mail server is responsible for delivering the message to the addressee.

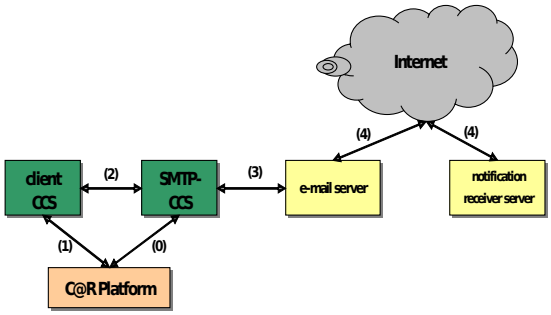

Fig. 4 Service components communications

Apart from the steps presented above, the SMTP-CSS registration on the platform (marked with "0") is required for the proper functioning of the service. This step enables other components to find the server and use the service it provides.

V. Summary and further work

The article presented the IT platform of cooperation and its role in the process of rural areas development support. The basic assumptions of the Collaboration@Rural (C@R) project, implemented under the 6th Research and Technical Development Framework Programme of the European Union, were discussed as an important contribution to the support of stimulation of rural areas and preventing the phenomenon of digital exclusion. The three-layer reference model composed of the following layers: Collaborative Core Services (CCS), Software Collaborative Tools (SCT), and the so-called Living Labs was described in detail.

Moreover, a diagram of implementation of a selected component within the CCS layer was presented—a notification service using electronic mail.

Further works within the C@R project, which has entered into the second stage of its existence, will involve the validation of the results obtained within the CCS and SCT layers in the environment of RLL laboratories.

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