Service-oriented Support of Cooperative Workflows

Considerations for Urban Planning Processes

Jochen L. Müller[1], Ge Zhang[1], Jean-Christophe Lapayre[2], Paul Müller[1]

[1]Integrated Communication Systems Lab
University of Kaiserslautern
67655 Kaiserslautern, Germany
jmueller@informatik.uni-kl.de

[2]Laboratoire Informatique
Université de Franche-Comté
25030 Besancon, FRANCE
jean-christophe.lapayre@univ-fcomte.fr

Abstract: Web-based information sources have evolved to an essential element in our daily and professional life. To process this faster and faster growing amount of information, web portals provide personalized access to specific information and communication services. In this paper, an example from urban planning is given. In this workflow, different actors are interacting in an ad-hoc manner. Therefore, a Portal Architecture has been built up, which provides the relevant information. This paper proposes a Service Orientated Architecture to provide access to business processes, software applications and hardware resources in a workflow oriented way.

1 Introduction

Information and Communication Technologies (ICT) are increasingly finding the way to all fields of human societies. This result comes from the following two assumptions. First of all, the computerised workflow is more efficient, quicker, more powerful and more cost-effective than the traditional workflow. Secondly, computerisation will bring social change in our relations. Since a few years the e-business wave has reached local governments. The label e-government comprises software and hardware applications with the objective to support processes between government and government (G2G), government and citizen (G2C) and government and business (G2B) [Dri03]. These new technologies will influence the way how governments do business, make reengineering of the processes during the integration of these technologies necessary and provide new communication structures between involved participants [Ebe04].

This paper proposes PROSA, a Process Oriented Service Architecture, to support urban planning processes. This architecture is based on a framework of web applications to provide a personalized interface to the actors, and a Service Oriented backend, which is integrated in the heterogeneous operating systems and makes cooperation among different institutions possible.

The rest of this paper is organized as follows. Section two analyzes the problem and presents results from a survey that is conducted in an interdisciplinary research project in Rhineland-Palatinate. Section three focuses on the Service Orientated Architecture and Web Services and points out the advantages of SOA for Urban Planning Processes. Section four illustrates the architecture of PROSA and section five draws a conclusion.

2 Problem Description

In Germany, the "town and country planning act" aims at controlling the use of land and providing statute for the planning and development in rural and urban areas. This is realized by a two steps approach, called "Urban Land Use Planning" (ULUP) which follows top-down logic. It begins with a "Land Use Plan" (LUP), i.e. a rather vaguely designed plan, which includes data from demographic analysis, economic projections, and current land use analysis. The second step is a detailed Local Plan (LoP) which includes regulations for architects and civil engineers.

The development of a strategic vision for a region is based on the analysis of its past development, as well as identification and analysis of current issues, trends, and conditions. These tasks are embraced by a six steps workflow, which guarantees involvement of different actors and aims at leading to a high quality plan. In each stage, different authorities, like civil engineers, neighbor communities or technical authorities, have to be involved. This means a lot of communication and coordination effort for the responsible authorities [St03].

The importance of LUP has widely been accepted. Only this instrument combines actual trends with a long-term vision for the region. Most communities fear the development of a new LUP, because of its complicated regulations, the long running process and the occurring costs. Hence, the ages of the plans are too old to perform the strategic task (see Table 1) [St03].

Table 1. Age of LUP

Age / Years	0 – 5	5 - 14	14 - 24	> 24
Amount	44 %	16 %	32 %	8 %

In the last years, the need for governmental re-organisation has largely been discussed [Ebe04]. Most of that movement has been initialised through applying Information Technology to this context and consequently the term e-Government is generally used. Implementing software that supports processes of public authorities faces the difficulty that these institutions have specific requirements [MuHe04]. Therefore, the modelling framework must take into account several specific needs and regulations.

3 Service Oriented Architecture for Urban Planning Processes

Urban planning is one of the oldest types of wicked problems [RiWe72]. Additionally, it is complex and therefore computer support is needed. As a consequence, the solution process is a socio-technical process where human and software agents interact. Such processes are quite lengthy, time and cost intensive. Hence, a systematic improvement is appreciated. Further on workflows are delivered mainly in an ad-hoc manner, the different actors are highly distributed and are working on heterogeneous software systems. Therefore, it was decided to extend the existing portal concept with the principles of the Service Orientated Architecture (SOA).

Another advantage for SOA in the context of Public authorities lies in the criteria that governments do not sell products to customers in a competitive environment, but can adapt solutions and learn from each other in a cooperative way.

3.1 Service Oriented Architecture

The Service Oriented Architecture (SOA) provides a standard platform facilitating the interoperability among applications residing in heterogonous environments and is the base of future Enterprise Application Integration strategies. SOA allows through abstracted Web interfaces, software systems developed with different programming languages, running in different operating systems, or on different hardware platforms to cooperate easily with each other. Figure 1 illustrates a service oriented usage scenario, including a s*ervice provider,* a *service broker* and a *service user*.
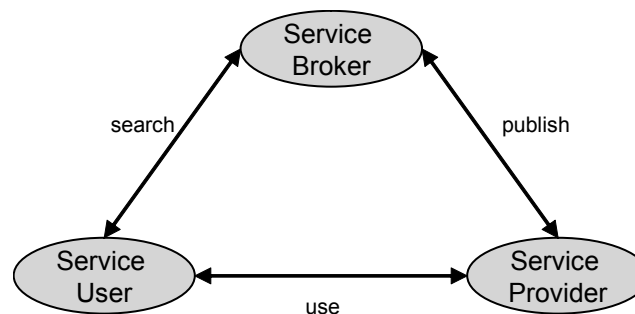

Figure 1. Roles in SOA

3.2 Web Service Standards

Web services can be defined as "self-contained, self-describing, modular applications that can be published, located, and invoked across the Web" [Cur02] The importance of Web services has been increasing in the past years significantly, because of increasing demands on loosely coupled and distributed applications. Web Service Technology combines the advantages of two established technologies, namely XML (Extended Markup Language) and RPC (Remote Procedure Call). Loose coupling and simple integration of software components into applications, irrespective of programming languages and operating systems is realized by using standards like XSD for data type definitions, WSDL [Ch01] for the description of the services, SOAP [Gud03] to access the services, and HTTP [Fie99] as an underlying transport protocol.

3.3 Related Work

The use of Service Orientated Architectures to support processes within communities in public authorities (e.g. urban planning) has not been discussed so far according to the authors' acknowledge, although the characteristics of public authorities provide good conditions for these architectures. Therefore the related work here only describes research on Portal Architectures and cooperative workflows.

In [Zirp03] the Gibraltar portal architecture is presented, which has some similarities to the here presented approach. But the application domain of its services concerns only digital libraries, and therefore process and workflow support is not issued. In [Novo04] a portal framework is presented, aiming to support the development of modular web components. This framework provides the core functions of a portal architecture, but it does not support service provisioning.

In [Mece01] cooperative processes are issued. But this paper proposes more a methodological and technological approach than a model for an architecture. [Sipo04] describes a Grid Portal to support collaborative workflows. It aims at supporting the information and knowledge exchange along the value chain of organisations. Knowledge strongly depends on the application domain. Therefore it is more promising to develop a domain specific architecture.

4 A Process Oriented Service Architecture (PROSA)

Urban planning is a typical socio-technical process where human and software agents interact. The different roles and needs are presented in part one of this section. The ideal platform for these interactions is portals, which provide a one-stop access to relevant data, software and hardware resources. Further on the portal offers a graphical interface to the human actors of the workflows. The portal concept is described in part two. To support the communication with the other actors along the workflows, it is important to provide a single-sign on mechanism which provides access to services distributed in federated organisations. This mechanism is described in the last part of this chapter.

4.1 Roles and Service types in Urban Planning

Urban planning is based on sustained and substantive public involvement designed to bring out local perceptions and knowledge. This is necessary to create successful plans and strategies. Five different actors are interacting along the workflow [MH04]. Each actor represents an important role within the workflows. Beside the responsible community civil engineers, neighbour communities, citizens, technical authorities, are involved to communicate and coordinate their efforts with the responsible authority. According to their workflow context, different services are provided.

The workflow is based on different information sources, which includes data from demographic analysis, economic projections, and current land use analysis. Further on different software applications are needed, e.g. Geographical Information Systems (GIS) to process specific geographic data. At least, it would be possible to virtualize hardware resources as services, and offer them to small authorities that do not have enough computing power.
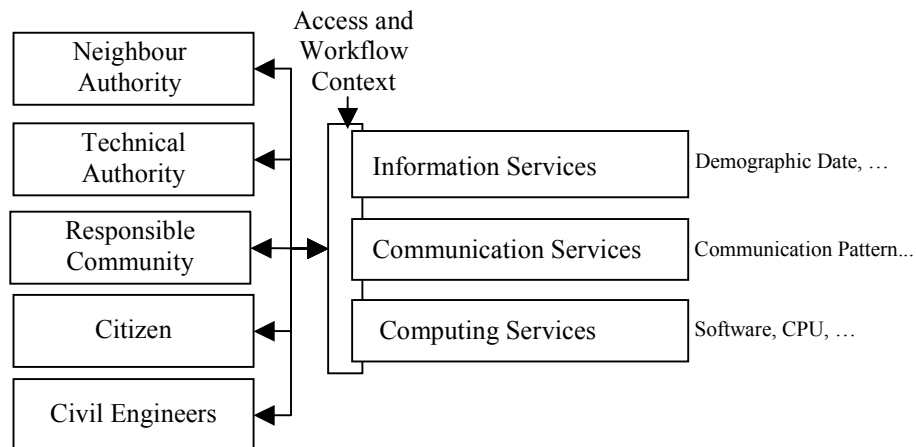

Figure 2. Actor orientated Service Provisioning

4.2 Portal Architecture

As a first step to support process in the area of town planning, it was decided to set up a web portal, which gathers the relevant information and functions to this topic together. Such a portal framework can be seen as a major tool for a flexible and dynamic process environment. In the area of structured content, information related to the relevant business process becomes more and more important.

The process support is based on two main components, the role-based and the workflow-oriented support. The role component provides users with the information and functions, which are necessary for their roles. The workflow component identifies all information and functions that are relevant for a specific process within the workflow. These two components present a personalized access to the actors [MuHe04].

The framework is described in greater detail in [HiRe04] and is based on the Model-View-Controller (MVC) design pattern. MVC strictly divides any application into a data model containing all the data, a controller which is responsible for the data flows and manipulation within the application, and one or more views upon the data which presents the information to the end user (c.f Figure 3).
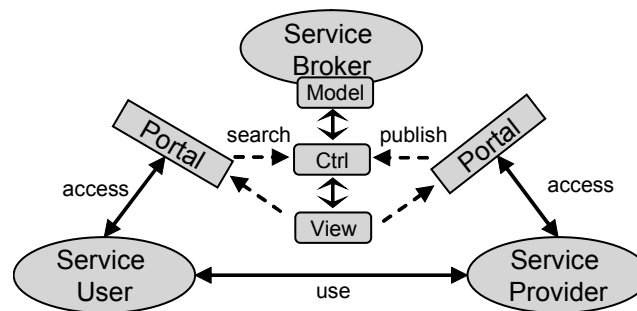

Figure 3. Service orientated Portal Architecture

The design pattern makes it possible to change the data inside the model while the views are updated automatically. The data models have been realized using JavaBeans, while the views and the controllers are implemented as Java Server Pages. Because of MVC, it is now possible to be expanded to a SOA.

4.3 Single Sign-On to Federated Domains

Web based cooperation is getting more and more important, not only for distributed organizations, but also for inter-organizational workflows. For the case of two organisations that are working together closely, the ability of a Single Sign On (SSO) mechanism is highly desirable. However none of the organisations would agree to change their complete authentication infrastructures to adapt to the infrastructure of the other.

An SSO environment is an authentication infrastructure that provides a single authentication authority for all authentication processes by outsourcing authentication processes to a specialized infrastructure that handles authentication for all applications. In [Cler02], SSO is defined as follows:

"Single sign-on is the ability for a user to authenticate once to a single authentication authority and then access other protected resources without re-authentication."

In order to access the necessary workflow services, a token-based single sign-on strategy is the most promising approach [Hill05]. A user has to authenticate himself once and will then receive a token allowing him to proof his identity in any further communication by providing this token. If the user is accessing a service, this token will allow the user not only to proof his identity, but also to proof his right to access this service. As there may exist different services involved in an overall workflow, it is very important to use an authentication and authorization strategy based on the single sign-on mechanism.

4.3 Implementation

The implementation is based upon flexible and future proofed software components, which will be described next. Main components are the PostgreSQL database, Java Beans, the apache tomcat JSP Container, apache axis, IBM BPWS4J and the apache web server. The basic elements are described in [HiRe03]. Axis is a SOAP implementation developed and distributed by Apache. It is realised as a plug-in of the apache tomcat. With Axis it is now possible to implement Java Web services. Further on PROSA supports orchestration and choreography of Web Services. Therefore the IBM Business Process Execution Language for Web Services Java^{TM} Run Time (BPWS4J) was implemented.
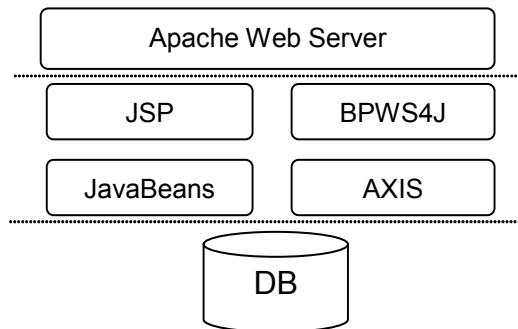
Figure 3. Process Oriented Service Architecture

At present the dependability of this framework is tested. Urban planning workflows are long running business processes. Therefore, it is important not to lose a certain workflow instance. Further on it is aimed at presenting the user specific characteristics of the service, e.g. availability or costs. This information provides knowledge to the user, on which a decision can be made.

5 Outlook

This paper proposes PROSA, a service orientated architecture for a web portal to support urban planning processes. The framework is based on open and state of the art components. Urban Planning Processes have been analysed through an empirical study in 2003. Based on the results, the needs of the involved authorities have been identified and different solutions have been developed to support the overall workflow.

In a first step a single sign on mechanism has been developed and integrated to provide access to federated domains. PROSA provides an interface for different service providers and service requestors that are focused on these processes. In the future it is expected that different actors involved in the urban planning processes will develop and provide their own services to support the planning processes.

In the near future it is planned to add further functionalities to the portal. Several Web Service components are already planned and will be implemented step by step. Furthermore, the architecture of PROSA will be expanded by the functionality of orchestration and choreography of Web Services. Therefore, the technology of BPEL4WS (Business Process Execution Language for Web Service) will be used and at present existing BPEL4WS engines are tested [Muel05].

Bibliography

[Chri01]   E. Christensen et. al.: Web Services Description Language (WSDL) 1.1 [online], 2001, World Wide Web Consortium W3C, available from World Wide Web: http://www.w3.org/TR/wsdl

[Cler02]   J. de Clercq: Single Sign-On Architectures, Infrastructure Security, International Conference, InfraSec 2002, Bristol, UK, October 2002 Proceedings S.40-58

[Curb02]   F. Curbera et al: Unraveling the Web Services Web, IEEE Internet Computing, March/April 2002, 86-93, 2002

[Drid03]   F. Dridi: Sicherheitsarchitektur für internetbasierte Informationssysteme: Entwurf und Implementierung des E-Government-Projekte Webocracy, Köln, 2003.

[Eber04]   D. B. Eberhard, et. al: E-Gov-Risk-Board – Lebenszyklusorientierte Identifikation bei E-Government-Anwendungen. In: F. Felt A. Oberweis, B. Otjacques (Ed.): Emisa 2004 – Informationssysteme im E-Business und E-Government, Bonn 2004, S. 270 - 283

[Fiel99]   R. Fielding et. al: Hypertext Transfer Protocol -- HTTP/1.1 [online], 1999, World Wide Web Consortium W3C, available from World Wide Web: http://www.w3.org/Protocols/rfc2616/rfc2616.txt

[Gudg03]   M. Gudgin et. al: SOAP Version 1.2 Part 1: Messaging Framework [online], 2003, World Wide Web Consortium W3C, available from World Wide Web: http://www.w3.org/TR/SOAP/

[Hill05]   M. Hillenbrand et. al: A single sign-on framework for web-services-based distributed applications. In Proceedings of the 8th International Conference on Telecommunications ConTEL (Zagreb, Croatia), 6 2005

[HiRe03]   M. Hillenbrand, B. Reuther: Building Blocks for Web Applications, 7th IASTED International Conference Internet and Multimedia Systems and Applications IMSA Hawaii, USA, 8/2003, pp. 757-761.

[Mece01]   M. Mecella et. al: A Repository of Workflow Components for Cooperative e-Applications, proceedings of the 1st IFIP TC8 Working Conference on E-Commerce/E-Business (Salzburg, Austria, 2001), BICE Press,

[MuHe04]   J. Müller and D. Henrici: Computer-Aided Dynamic Processes for Urban Land Use Planning, in Work in Progress Session of 30th EUROMICRO, Rennes, France, 2004

[Muel05]   J. Müller, et. al: Integration und Orchestrierung von Geschäftsprozessen in Web Applikationen – Ein Service-Orientierter Ansatz, in Richard Lenz et. al (Hrsg.): EAI-Workshop 2005 – Enterprise Application Integration, GITO-Verlag

[RiWe72]   H.W.J. Rittel, M. M. Webber: Dilemmas in a General Theory of Planning. Working Paper No. 72 - 194, University of California, Berkeley, CA., 1972

[Sipo05]   G. Sipos, et. al: Workflow-Oriented Collaborative Grid Portals, in Proc. of European Grid Conference, LNCS, Amsterdam, 2005

[Stein03]   G. Steinebach: Informations- und Kommunikationssysteme im Verfahren der Bauleitplanung - zugleich ein Beitrag zum Entwurf des Europarechtsanpassungsgesetz Bau, in: Zeitschrift für deutsches und internationales Bau- und Vergaberecht, Heft 1/2004, S.16 ff

[Zirp01]   C. Zirpins, et. al: Advanced concepts for next generation portals. In Proc. First International Workshop on Web Based Collaboration WBC. IEEE, 2001.