eGovernment Service Marketplace: Architecture and Implementation

Elena Mugellini[1], Maria Chiara Pettenati[1], Omar Abou Khaled[2], and Franco Pirri[1]

[1] Department of Electronics and Telecommunications, University of Florence
{mugellini, pettenati}@achille.det.unifi.it, fpirri@ing.unifi.it
[2] Department of Computer Science, University of Applied Science of Western Switzerland
omar.aboukhaled@eif.ch

Abstract. In order to provide citizens with quality services, respecting public administrations autonomy, we propose a new concept of eGovernment Service Marketplace (eGovSM). This paper presents an overview of the architecture and implementation of eGovSM easing the automatisation of administrative process involving several administrations and allowing the reuse of data. This architecture facilitates citizens' interaction with different public administrations by providing them a single and personalized access point to services. The eGovSM is formalized using a set of XML Schema models in order to support the realization of an interoperable and open system. The architecture is based on four main functional modules: UNICITIDM (UNIiversal CITizen IDentifier Manager) a module for the creation and management of citizen unique identifiers, LEM (Life Event Manager) for the management of all citizen interactions with the marketplace, DM (Document Manager) for the management of administrative process execution and SM (Service Manager) for the management of all public administrations interactions with eGovSM.

1 Introduction

The main e-government challenge is to facilitate citizen-public administration interaction enabling seamless services delivery to citizen through the network [1]. E-government services frequently need to link and use data from multiple and diverse information resources. Consequently, "interoperability" is the key word to address e-government challenges. Interoperability is not only a technical issue dealing with distributed computing, but it deals also with information sharing among different administrations and the redesign of administrative processes to support more effective delivery of e-government services. Three level of interoperability are relevant to e-government issues: technical, semantic and organizational [1]. The first one refers to technical issue of connecting computer systems, defining common communication protocols and data formats. The second one concerns the exchange of information in an understandable way even between applications that were not initially developed for this purpose. The third one refers to enabling processes co-operation. While interoperability requirements seem so obvious, today's reality is that information systems are not yet interoperable, different administrations are able neither to share and reuse data nor to cooperate for fulfilling e-government challenges.

Many e-government projects are being developed and various approaches have been proposed for the design and the development of an architecture to deliver e-government services to citizens; but, to our knowledge, the interoperability problem is not completely resolved yet [1].

The one that follows is a short analysis of three of the main e-government European projects (eGOV project [4], FASME project [7] and EU-PUBLI.com project [10]) together with a brief discussion of the differences between their proposed solution and our approach.

eGOV project proposes an architecture to enable “one-stop government” [6]. The architecture is made of a portal and a middleware component. The portal is the citizen access point to the system while the middleware is the component responsible for executing the requested service. In order to describe services a markup language (GovML) has been developed [5]. The GovML defines a set of metadata to describe public administration services and life events. The main advantages of the proposed solution are the provision of a single access entry to the system and the definition of a standard set of metadata to describe administration services. The main disadvantage is that each administration is obliged to implement the proposed architecture in order to provide the services and share data.

FASME project [8],[9] focuses on supporting citizen mobility across European countries by the integration of administrative process spanning among administrations belonging to different countries. In order to satisfy this objective a smart card is provided to citizen for the storage of all personal information and documents. Services are delivered through dedicated kiosk. The main advantage of the project is the idea of providing the user with a card that can authenticate him to the system while the main disadvantage is that citizens are obliged to reach the kiosk in order to access and use the system.

EU-PUBLI.com project [11],[12] defines a Unitary European Network Architecture. It proposes a middleware solution to connect heterogeneous systems of different public administrations and to enable a service-based cooperation between public administrations. The main advantage of this project is that the proposed solution respects the autonomy of each single administration and enables interoperability between different organizations. The main disadvantage is that it is a back-office solution and it doesn’t provide support for documents delivery to citizens.

To make it easier for citizens to interact with administrations and to obtain services in a transparent way it is necessary to propose a system which both provides services according to citizen needs and respects public administrations autonomy and authority. The eGovernment Service Marketplace [23] proposes an architecture that:

- provides citizen oriented services (that is provide services to citizens every time they need, wherever they are and in a personalized way)
- respects the autonomy of the single administration (that is it doesn’t obliged each single administration to deploy an instance of the proposed architecture)
- provides a single access point to government services via the web
- performs the necessary operations for collecting the information to deliver government services instead of the citizen

From the one hand the proposed marketplace provides services according to citizen needs, using “life event metaphor” [2] to hide the complexity of administrative process. From the other hand it integrates public administration legacy systems allowing

public administration subscription to the marketplace according to four different interoperability levels. It is worth noting that in this first phase of system design and development we have decided to not take into account security and privacy issues since there are others projects that have already provided interesting solutions (for instance FASME project). Later on, we will better investigate the solutions proposed as well as the results obtained in these projects in order to evaluate a possible integration in our system.

2 The eGovernment Service Marketplace concept

The eGovSM main purpose is to provide quality citizen oriented services facilitating citizen to public administration interaction. As it happens in a traditional marketplace, where a citizen can buy the products he needs without caring about production and delivery process, the e-government marketplace aims at providing e-government services to citizens without requiring the citizen to be aware of administrative process complexity. For instance, for the delivery of a document, citizens will not be concerned with administration responsibility or geographical location of information. The eGovSM purpose is not only to use technologies to increase the efficiency of administrative process. It aims also to make it easier for citizens to interact with public administrations rebalancing relations between citizens and administrations, and presenting e-government services according to citizen needs. For this reason the eGovernment Service Marketplace aggregates services according to "life event metaphor" [2],[3] that is services are organized around events that make sense for the citizen and the citizen doesn't need to be aware of various public administrations involved in the delivery of such services. The life of citizens is described providing a list of events that when occurring in citizen life result in a series of transactions between a citizen and different public sector organizations. Examples of life events could be "looking for a job", "moving home", "learning to drive", "pensions and retirement", "having a baby" and so on.

The marketplace concept of service is the communication (transmission or reception) of a document (official document or information). When a citizen requests a service, the marketplace correlates the requested service with the corresponding administrative process and executes this process to deliver the document to the citizen. In order to let the marketplace interact with a public administration it is necessary that this administration subscribes to the system. Each administration wanting to join the marketplace has to subscribe to it, declaring its availability to provide services and share data with the marketplace. In order to respect public administrations autonomy the marketplace offers four different subscription profiles [see Service Manager Paragraph].

Fig. 1 shows the entities involved in the marketplace and possible interactions between them. From the one hand citizens access the marketplace via a portal, from the other hand public administrations subscribe to the marketplace in order to share data and provide services. The figure highlights three different types of public administrations (PAs). PAs of "type A" represent administrations subscribed to the eGovSM that automatically provide data to the marketplace without requiring the citizen to interact

with them. PAs of “type B” represent administrations subscribed to the eGovSM that, even if can automatically provide data to the marketplace, require a direct interaction with citizens (for example a hospital in case of a medical examination). Finally PAs of “type C” represent administrations that are not subscribed to the eGovSM and hence require a direct interaction with citizens to provide data.

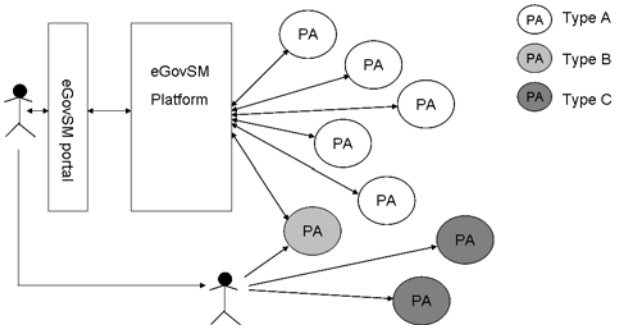

Fig. 1. eGovernment Service Marketplace, involved entities and interactions among them

The eGovSM is formalized using a set of XML Schema models [16]. This allows us to create an interoperable and open system. Public administration sector is a continuously changing world: public administration organization, responsibility and services are always in evolution. For this reason the design and development of an e-government system based on a set of formal models makes the system architecture more flexible and easier to extend in order to fulfill new public administration needs and requirements.

3 The eGovSM architecture

3.1 General overview

The overall eGovSM architecture is shown in Fig. 2. The platform is based on four core components: the UNIversal CITizen IDentifier Manager (UNICITIDM), the Life Event Manager (LEM), the Document Manager (DM) and the Service Manager (SM). The UNICITIDM component creates and manages citizens’ identifiers. The LEM component manages marketplace services creation and presentation to citizens and all the interactions with citizens. The DM component coordinates the execution of the administrative process. The SM component manages all the marketplace interactions with public administrations in order to retrieve the required data to deliver a specific service.

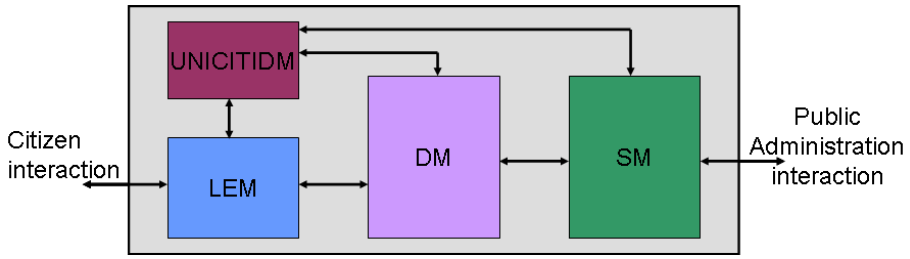

Fig. 2. Overview of eGovSM architecture

3.2 UNIversal CITizen IDentifier Manager

The UNIversal CITizen IDentifier Manager (UNICITIDM) is the module responsible for managing citizen identifier (UNICITID). The UNICITID is an identifier containing citizen personal information; it is unique and not variable. Its purpose is to allow eGovSM to find out the administrations responsible for citizen personal data. The UNICITID has a URN-like (Uniform Resource Name) structure similar to the one defined in the NIR Project [13],[14],[15] that allows identifying citizens of any country by providing a uniform, but adaptable, schema for defining country-specific identifier structure. The UNICITID is created the first time a citizen access the eGovSM platform and it is used only by the marketplace, remaining transparent to the citizen. The eGovSM provides only the basic structure of this identifier allowing administrations of different countries to extend and to adapt it to the specific public administration structure of their own country. As a consequence each eGovSM is able to interpret only identifiers coming from its country, but, thanks to the country identifier contained in every UNICITID, it can identify the eGovSM platform capable of managing a foreign identifier. The one that follows is an example of UNICITID:

- it:it:rossi.luca:1960-04-08:it.toscana.firenze:codicefiscale

The first field indicates the country responsible for the identifier (in this case “it”= Italy) and it is common for all the identifiers while the last one (“codicefiscale”) represents a country-specific information. The eGovSM in order to retrieve, for instance, citizen address uses the birthplace information “it.toscana.firenze” and starts contacting administrations of “firenze”, then of “toscana” and so on, until it finds the searched information.

3.3 Life Event Manager

The Life Event Manager (LEM) is the manager of all the interactions of a citizen with the marketplace (Fig. 3). It is the eGovSM component who presents available services to citizen and manages citizen service requests.

The LEM is responsible for creating, publishing and updating life events list in order to provide citizens with up to date and personalized list of available services in the marketplace. LEM is also responsible for citizen subscription and authentication as well as citizen service request management. When the eGovSM receives the citizen request, the LEM correlates the requested service with the corresponding administra-

tive process creating a Process Descriptor. The Process Descriptor (PD) specifies the administrative process corresponding to the requested service; it describes the constraints to satisfy and the operations to do in order to deliver the service. A Process Descriptor is associated to each service provided by the marketplace, but depending on the citizen who is requesting it (where he lives, which are the administrations responsible to deliver the document) the number and the type of operations to do, for the service delivery, could vary. When the requested service concerns the delivery of an official document (that is a document with a well defined structure like a certificate), associated to the Process Descriptor there will be also a Document Descriptor. The Document Descriptor (DD) specifies the structure of this official document, i.e. the data it contains, constrains associated to that data and the way the data have to be aggregated in order to generate the document.

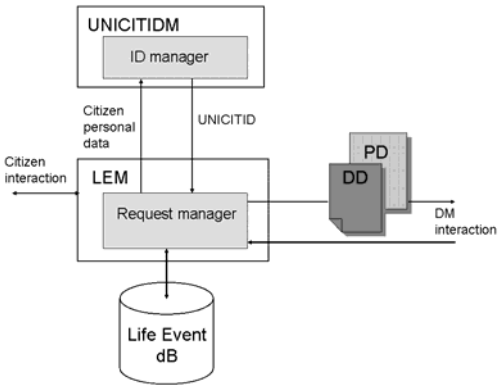

Fig. 3. Interaction between UNICITIDM and LEM modules

Finally the LEM tracks the process executed by the Document Manager in order to inform the citizen about the necessary time required to complete the service. For example, let consider that the citizen selects the service “getting your driving licence”. The LEM has to create the Process Descriptor and Document Descriptor associated to this service. The Process Descriptor contains all the steps to be followed and the order in which they have to be executed to deliver the driving licence document. For example it establishes that before collecting the data and delivering the document to the citizen, the system has to check if the citizen has or has had problems with law, or if he has already passed the medical examination to obtain the driving licence. The Document Descriptor defines the structure of the driving licence document. It describes which information it is necessary to retrieve and how it has to be aggregated in order to create the document and which are the constraints associated to this information (for example it will check if the validity period of the document against the citizen age).

3.4 Document Manager

The Document Manager (DM) is the component responsible for administrative process execution (Fig. 4).

The DM main purpose is the management and coordination of all the operations necessary to collect the required data and to deliver the document the citizen has requested. In order to do this, it uses the Process Descriptor and Document Descriptor created by the LEM. The DM work is subdivided into two phases: in the first one it has to verify the fulfilment of prerequisites associated to the service while, in the second one, it has to coordinate all the operations to retrieve the necessary data. Finally DM uses a repository to register information regarding the process execution status. In case of a process interruption, due to logical or technical reasons, the system will be able to continue and finish the process later on.

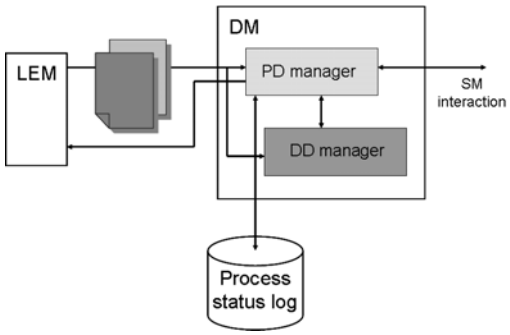

Fig. 4. DM module

3.5 Service Manager

The Service Manager (SM) is the coordinator and manager of all the marketplace interactions with public administrations (Fig. 5), providing DM with a homogenized access to the heterogeneous public administration information systems.

SM has also to mange public administrations subscription to the eGovSM. In order to allow public administrations to subscribe according to their capabilities it provides four subscription profiles. The basic profile (profile 0) refers to administrations that are not able to provide electronic data. The second profile (profile 1) refers to administrations that can provide elementary electronic functionalities (for example access and query to a database). The third profile (profile 2) refers to administrations that are able to provide a richer set of functionalities (for example implement web service technology). The fourth profile (profile 3) refers to administrations that deploy an instance of the eGovSM platform. This will enable future collaborations among eGovSM platforms of different countries or among administrations that will decide (without being obliged) to deploy their own eGovSM instance.

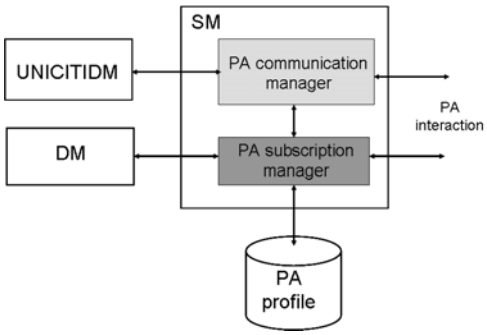

Fig. 5. SM module

4 eGovSM Prototype development

At present a prototype is being developed in order to test and validate the proposed architecture. The prototype development is based on a .NET platform [17]. The choice of such kind of platform (.NET or J2EE) is dictated by the many offered facilities, for instance the rapidity of development process thanks to the set of provided APIs and high configurability possibilities (system issues, database access, security constraints, etc). Moreover, these platforms are based on the use of XML technologies which offers a high degree of interoperability. Finally, both the platforms fully support Web Services technology which represents the future of distributed developing approach. Our choice of using .NET platform was motivated by the following additional features:

- support of the Office suite, largely used in administrations, which facilitates administrations interaction with eGovSM system
- support of multi-language. .NET platform supports up to 20 different languages allowing the integration of already developed applications by different public administrations
- inclusion of a full API for the treatment of XML Schemas which eases the integration of our XML Schema models
- easy support of the deployment of applications compliant with .NET specifications and support for implementation on Linux ("Mono" project [18]) as well as Windows operating system

Figure 6 shows the citizen access interface to the eGovernment Service Marketplace. The interface is divided into three main parts:

- the first one, on top of the page (Fig. 6, reference 1) provides the service research by keywords and access policy management functionalities
- the second part (Fig. 6, reference 2) provides the complete marketplace life events list, its main purpose is to help citizen navigation in the marketplace
- the third part (Fig. 6, reference 3) is the principal one and it is used by the citizen to search a service, obtain detailed service information, ask for a service and obtain information on ongoing service requests

Fig. 6. Access interface of eGovSM portal

It is worth noting that even if the current version of eGovSM Portal is in French, thanks to the system modeling with XML technologies, multilingualism is easily supported. Moreover the system is highly flexible and easy extensible: inserting additional life events or services, for example adding the "marriage" life event, doesn't require to redevelop the application, but it only requires to add the information concerning the new life event in the database respecting the XML Schema specification and the new life event will be automatically included in the eGovernment Service Marketplace and displayed on the portal.

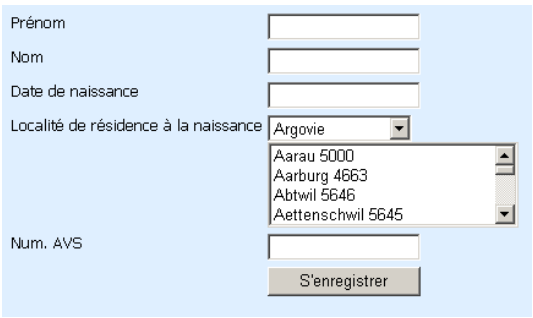

Fig. 7. Example of citizen subscription application form

In order to obtain a service a citizen needs to subscribe to the eGovSM i.e. he has to provide some personal data by filling in the proper subscription form (Fig. 7), and the system will use them to create the citizen UNICITID. Afterwards, the citizen, using this identifier, can connect to the eGovSM and ask for a service.

If a citizen doesn't subscribe to the eGovSM he can only navigate into the marketplace and access to service information but he cannot ask for a service (the "obtenir le service" command is disabled, see Fig. 8, reference 3).

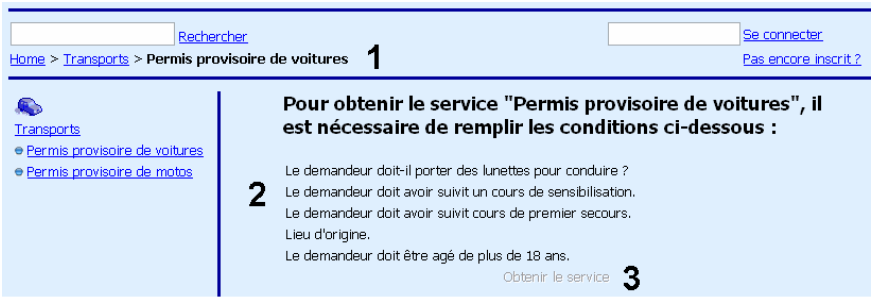

Fig. 8. eGovSM portal: example of service detailed description

In order to help citizen navigation in the eGovSM, just below the search by keyword functionality is displayed the navigation path, making easier for a citizen to "orientate" himself in the marketplace (see Fig. 8, reference 1).

4.1 Prototype Testing Scenario

As prototype testing scenario we have chosen the "obtain driving license" service (in figure 8 "permis provisoire de voitures"). This service requires both the collecting of information coming from different administrations (municipality, hospital and department of motor vehicle) and the satisfaction of different constraints (medical examination, moral requirements). All the information concerning such service (for instance service requirements and constraints) is provided to the citizen (Fig. 8, reference 2). Once the service request is sent, the citizen is informed about service delivery progress (Fig. 9).

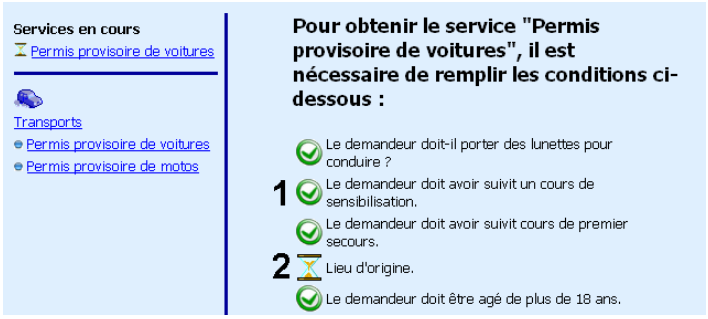

Fig. 9. eGovSM portal: example of service request execution

The “checked” icon (Fig. 9, reference 1) informs him that the specific task has been successfully completed, while the “hourglass” icon (Fig. 9, reference 2) informs him that the system has not completed the task yet. Two other possibilities are taken into account: a “cross” icon meaning that the task has not been successfully completed (for instance a constraints that has not been satisfied) and a “question mark” indicating that the system was not able to find the information among the subscribed administrations. Once the service has been successfully delivered, the marketplace sends a message to the citizen, informing him that he will receive the requested document by ordinary mail from the responsible administration. At present the prototype simulates also the generation of Provisional Driving Licence document (Fig. 10).

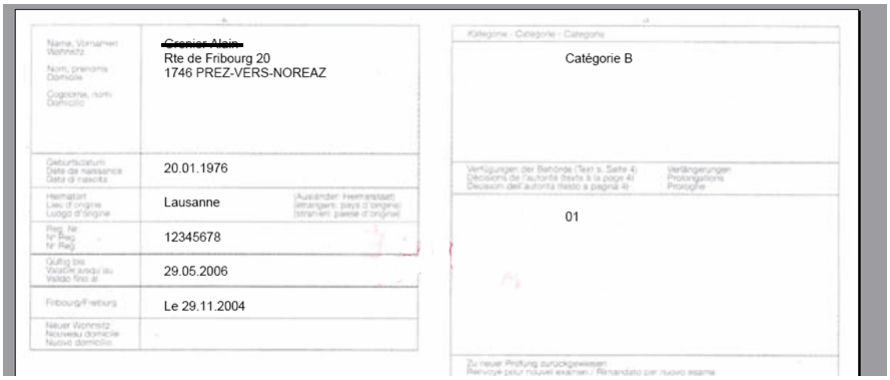

Fig. 10. Example of “Provisional Driving Licence” document generation

5 Conclusions and Future work

This paper proposes a new approach to deliver services to citizen based on the concept of eGovernment Service Marketplace (eGovSM). The marketplace main objective is to provide quality citizen oriented services i.e. providing services according to citizen needs. In order to do this, the marketplace publishes services according to the life event metaphor, hiding to citizens the complexity of administrative process associated to each service. The eGovSM is formalized using a set of XML Schema models; the architecture itself is based on these models. An implementation of the eGovSM system, currently under development, will constitute the test-bed for further analysis and investigations to improve the architecture.

Further work is needed in order to investigate the use of Grid services to dynamically discover public administrations and their data resources.

At present we are envisaging the possibility of adapting and integrating in our system the results of GRACE European project [20]. The main goal of this project was to develop a Grid based search tool for digital library that is a service to search information through heterogeneous resources stored in geographically distributed collections [21],[22]. Our idea is to adapt the already developed searching mechanism into the e-government domain in order to discover public administrations information resources.

This would eventually allow eGovSM platform to dynamically discover and locate relevant public administration resources; for instance, in case of replication of several eGovSM platforms across different countries, we can envisage the use of a Grid discovery service to locate foreign eGovSM platforms.

References

1. IDA report, “Linking up Europe: the Importance of Interoperability for eGovernment Services”, European Commission 2003
2. Dipartimento per l’Innovazione e le Tecnologie Allegato n.1, “Front-office e servizi di e-government per cittadini ed imprese”, Presidenza del Consiglio dei Ministri, 2002
3. Ireland life event classification: http://www.oasis.gov.ie/siteindex/by_life_event.html
4. The eGOV Project Website: http://www.egov-project.org/
5. G. Kavadias and E. Tambouris, “GovML: A Markup Language for Describing Public Services and Life Events”, 4th Working Conference on Knowledge Management in Electronic Government, 2003
6. Deliverable D312 of eGOV project: “Platform integration and deployment report, description of the trials”, 2003
7. The FASME Project Website: http://www.fasme.org/index-org.htm
8. Deliverable 6.1 of FASME project: “The Conceptual System Architecture of the FASME Project”, 2001
9. Deliverable 6.2 of FASME project: “The FASME Prototype”, 2001
10. The EU-PUBLI.com Project Website: http://www.eu-publi.com
11. M. Contenti, A. Termini, M. Mecella and R. Baldoni, “Supporting Inter-Administration Cooperation: The EU-PUBLI.com Approach”, 3rd International Conference on Electronic Government, 2004
12. Deliverable D2.1 of EU-PUBLI.com project: “Report on EU-PUBLI.com Architecture Prototype”, 2004
13. NIR Project Website: http://www.normeinrete.it/
14. A. Marchetti, F. Megale, E. Seta and F. Vitali, “Using XML as a mean to access legislative documents: Italian and foreign experiences”, First European workshop on XML and knowledge management 2002
15. C. Biagioli, E. Francesconi, P. Spinosa and M. Taddei, “The NIR project: Standards and Tools for Legislative Drafting and Legal Document Web Publication”, ICAIL 2003- Workshop
16. World Wide Web Consortium, “XML schema part 0: Primer”, from http://www.w3.org/TR/xmlschema-0/
17. J. Sharp and J. Jagger, “Microsoft Visual C# .NET step by step”, Microsoft press 2003 ISBN: 0735619093
18. Mono Project Website: http://www.mono-project.com/about/index.html
19. O. Zimmermann, M. Tomlinson and S. Peuser, "Perspectives on Web Services: Applying Soap, Wsdl, and Uddi to Real-World Projects (Springer Professional Computing)", Springer-Verlag, 01 October, 2003. ISBN: 3540009140
20. GRACE Project Website: http://www.grace-ist.org/
21. J. Siddiqi, B. Akhgar and M. Naderi, “Towards a Grid Enabled Knowledge Management Services”, UK e-Science All Hands Meeting 2003
22. G. Haya, F. Scholze and J. Vigen, “Developing a Grid-Based Search and Categorization Tool”, High Energy Physics Libraries Webzine 2003
23. eGovSM Project Website: http://www.eif.ch/projets/egovsm/