

A Method for Implementing Interoperable Electronic Services Portals in Local Administrations

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Abstract: One of the most active fields in information technology nowadays is the provision and transformation of electronic services, including complete transactions with citizens and enterprises, through services portals developed by governmental organizations. Most important in this t-Government roadmap, is the methodology for developing interoperable Electronic Services, through the cooperation between heterogeneous, front-desk and back-office public administration systems. The overall goal of this paper is to propose a methodology for interoperable electronic services for local administrations, which comprises of (a) rapid process modeling using of BPMN-aware enterprise modeling tools, (b) CCTS-based data modeling in XML, (c) step-by-step adaptation of Content Management, Citizen Relationship and Workflow Systems, (d) SoA-enabled interconnections with back-office applications and (e) overall guidance based on a Standard Services Taxonomy. The methodology was developed and followed for the design, implementation and maintenance of the Municipality of Ano Liossia Electronic Services Portal, resulting in more than 30 electronic services at level-5 and level-4 (personalized or complete transaction), and the rest at level-3 and level-2 (electronic application or forms download) – hindered by the current legal status on validity of electronic certificates in Greece.

Keywords: e-Government, Standard Services Taxonomy, Process Modeling, Data Modeling, Interoperability, Local Administration Systems

1. Introduction

Nowadays, more and more organizations and especially local administrations and municipalities tend to offer Internet based services, replacing their traditional front-desk transactions. Following this trend, local governments, local administration and various public service offices are constantly launching e- Government portals that are not only offering information to the public, but also electronic services as well [1].

Municipalities are topping the list of such organizations, as they have high figures of everyday transactions numbers with citizens and also possess a large number of “clients”, which are naturally the inhabitants and the locally based enterprises [2].

Although a lot of relevant research and implementation projects are being carried out in the field of eGovernment at local and municipal level, and various electronic services are appearing every day, present methodologies fail to tackle issues such as:

- The construction of complete service taxonomies for the municipalities, so as to provide the complete set of electronic services at the needed sophistication levels.
- The specific capabilities of municipalities, that are limited if compared to larger, central public administrations.

- The utilization of complementary subsystems which will offer added value to a municipal eGovernment portal
- Generic interoperability mechanisms for encapsulating the required information flows between front-desk and legacy back-office systems.

This paper presents a complete methodological procedure for setting up Municipality Service Portals that was successfully applied in a Greek urban Municipality with almost 30,000 citizens and 1,000 enterprises and has been tested in different forms in several other Greek Local Administrations.

2. Objectives

The overall goal of this paper is to demonstrate a methodology for providing municipal electronic services. The methodology is supported by a pre-defined formally described Standard Taxonomy of services, data definitions and ready-made components and addresses the following objectives:

- Quickly capture requirements, by using standard templates and exploiting information for municipal services that are available through a prototype Interoperability Registry
- Rate the importance of the various electronic services for the citizens and enterprises, thus making a priority-based plan
- Select the services to be implemented, automatically, getting service metadata, electronic forms for integration within chosen Content Management System
- Choose the appropriate additional systems and components, that will be pointed out from the Standard Taxonomy
- Proceed with final adaptations and interconnection with back office systems.

This way, the implementation of a Services Portal resembles a pre-parameterized ERP implementation rendering Services Portal development to an abstracting, rather than additive, method.

3. Methodology

Nowadays, various Frameworks such as (UK e-GIF[13], German SAGA[14], Greek e-GIF [15], European Interoperability Framework (EIF IDABC) [16]) are present, offering the guidelines that should be followed when designing systems and applications seeking interoperability with underlying systems. Those frameworks are defining in detail:

- Certification Frameworks for Public Services web sites
- Interoperability structures for interconnecting systems and developing applications
- Digital Authentication structures for the end-users
- Standardization Meta-Data and XML Schemas for data entities

Many international standards and state-of-the-art modeling languages and technologies were used in the Municipality of Ano Liossia portal implementation as they preserve the feasibility, the accessibility and the security of the end product, which is the portal. The experience gained from other projects that address Service Taxonomy and Interoperability Issues (OntoGov, OneStopGov, SemanticGov) [20], [21], [22], was also taken into account for the development of the Standard Services Taxonomy and the interconnection between the Electronic Services Portal and the Municipal back-office systems.

A complete and rapid, step-by-step methodology which includes and transforms all the existing services of such an organization, as a Greek municipality, to electronic offered services, was developed in the case of the Municipality of Ano Liossia. The methodology achieves to tackle issues such as the process categorization to the different levels of automation by constructing service taxonomies that guide the overall portal implementation, the data and process modeling with the use of generic structures for the

complete set of services, the complementary subsystems which offer added value to an eGovernment portal and last but not least generic interoperability mechanisms for encapsulating the required information flows between front-desk and legacy back-office systems [18], [19].

3.1 Service Analysis, Categorization and Selection

The construction of the Standard Services Taxonomy for Greek municipalities was based on initial information gathered from the Ministry of Internal Affairs, the Greek Union of Municipalities, several EU-funded projects addressing Service Taxonomy Issues and relevant European services definitions. The Standard Services Taxonomy construction was based on the initial methodology used in other Greek Municipalities (Agia Paraskevi, Athens, Nea Ionia, and Megara), which was enriched and improved by the exploitation of the lessons learnt in previous cases. Then, real services data from the Greek Urban Municipality of Ano Liossia were compared with the existing data, available in the Interoperability Registry. This way, a complete tree of services was created, with more than 120 “atomic” services, documented with metadata, fully covering DublinCore (DC) and UK-eGovernment Metadata Standards (eGMS).

The 5-level model of the European Commission was adopted, stating five different levels for electronic services [3], [4], [5]. The evaluation of the services provided by the Municipality led to the plotting of a map containing particular services that are going to be provided to the public through the portal.

Extending DC definitions, various indicators were put in each service, which were used in a weighted, multi-criteria selection method for setting target sophistication levels for each service.

The parameters that were used for the sorting and the evaluation of the services are:

- Frequency of use, meaning the total request for the specific service
- Effort, describing the inter-organization work-effort which is required for completing the services life-cycle
- Importance (following European directives)
- Input Independence, which points out the required input documents for executing the service
- Support by Information Systems, describing whether the specific service is operated by using information systems
- Independence of Execution Frame, pointing out whether the service is provided within the “authority borders” of the municipality or whether contact and information flow between other organizations is required.
- Reliance on other Services, pointing out whether the service includes the execution of other services offered by the organization.
- Demand for onsite presence.

The results of the application of the method led to a service classification and ranking map based on their potential of becoming electronic, the respective automatic transaction level they can reach and their overall importance – thus providing for a service-driven overall guidance and prioritization of the portal implementation.

3.2 Process Modeling

The next step included modeling of the standard service with the use of Business Process Modeling Notation (BPMN) which is used for guiding system design but also for extracting executable Business Process Execution Language (BPEL), to be fed in any BPEL-aware Workflow Management System (WFMS). In such a way, almost 80 executable BPMN models, referring to level-3, level-4 and level-5 services, as well as prototype models for

licenses, certificates, applications, registries and payments were implemented, which simulated the complete process flow within the municipality.

The process modeling captured the flow of the steps, inputs and outputs for every service described, resulting in a coherent representation of:

- The Municipality internal processes followed for each service provided.
- The communication with other entities that provide accompanying services or support processes for the completion of a service.
- The input documents, the output documents and the service-internal documents.
- The various document exchange flows between the involved entities

The target of the above process modeling was the analysis of the existing situation (as-is) but mostly to drive the transformation of manual or lower-level electronic processes towards the implementation of level-3, level-4 and level-5 processes by the Municipal Portal.

3.3 Data Modeling

Unified governmental data models for facilitating the seamless exchange of information and the deployment of interoperable systems in Municipal Government appear today as critical yet less touched issues that deserve more in depth exploration [6]. The development of (a) a universal language to describe the semantics of governmental data in unambiguous terms and (b) repositories of XML schemas for the exchange of specific-context information throughout the public sector, albeit recognized as the most significant achievement in data modeling, seems to be the most critical research point in the data modeling field.

The UN/CEFACT Core Component Library (UN/CCL) represents the repository for generic business data components, the so called Core Components. Based on the experiences gained in previous data standardization efforts, the CCL does not provide Pre-determined, static or industry-specific data definitions, but comprises a huge set of context-agnostic, generally valid data templates that are syntax-independent and represent the general business data entities which are commonly used in business processes. The Core Component Technical Specification (CCTS) [7], [8] is the associated method comprising meta-models and rules for the semantically unambiguous definition of business information on a syntax-independent level. The UN/CEFACT Naming and Design Rules (NDR) [9] define a set of guidelines for transforming CCTS based artifacts into XML Schema and XML based instances.

In the case of Ano Liossia, data forms relating to each service were modeled using XML and UN/CEFACT CCTS structures. Over 150 different data forms involved in the services' process flows were collected and modeled connected to the respective service steps.

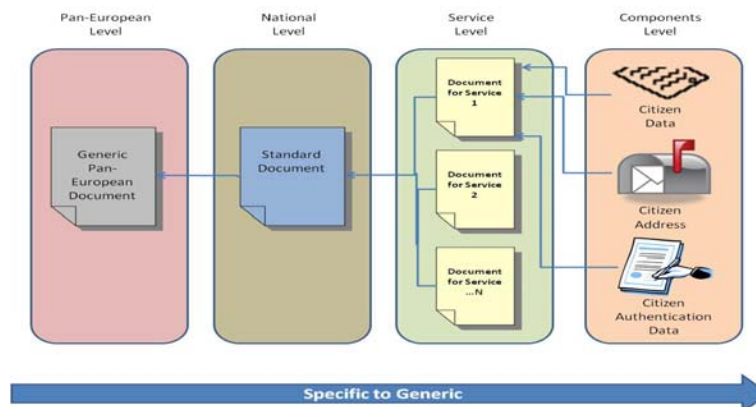


Fig. 1. Creation of Standard e-Government Documents using a CCTS-compliant Methodology

3.4 System Architecture

The system architecture is based on n-tier architecture (data layer, application layers, presentation layer).. The 3-tier architecture chosen allowed and guaranteed the sorting of operations in distinctive levels in order to avoid unequal burdens of particular sources, or of the whole system and offers the option of selective expandability with no changes in the system’s infrastructure. Figure 2 describes the logical architecture of the system, which contains parameterisable Common Off-the Self Components (COTS), open source components and be-spoke components. The core platform is an open source Content Management Platform System (CMS). This system handles the presentation of the information and offers out-of-the-box tools for the implementation of services belonging to levels 1 and 2. Other systems are Workflow Engines, Citizen Relationship Management Systems and IVR Systems for enabling voice access.

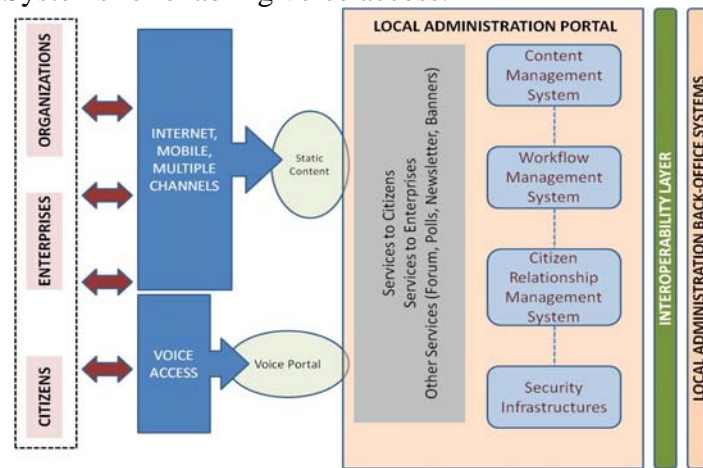


Fig. 2. Logical Architecture of the System

The Content Management Platform, the Citizen Relationship Management System (CRM) and the Workflow Engine all cooperate as the core transactional components of the system. The CRM serves the user authorization and identification and tracks down all user activities, namely from simple queries or questions asked to the current status of an online submitted application. This way, the end-user is constantly aware of his open issues and on the other hand, the administration authority is able to generate the end-users profile in order to target the most needed services [10].

Finally, the Workflow Engine offers the flexibility of adding, replacing and updating working processes, without requiring great code-writing efforts. This way the process flow is constantly managed and the system guarantees the flow of documents to the appropriate users even at heavy loads, surpassing the operation of manual systems in Local Administration [11].

3.5 Interoperability Layer

The interoperability layer is essential for the Municipality Portal, if services of level 3, 4 and 5 are offered to the public. The portal operates as a front-end interface for the Internet users, in order to be served by the Local Administration back-office systems. This layer is designed in such a way that future enhancements are possible and that system and platform independence is preserved. It contains “Encapsulation Software Components (Wrappers)” that are responsible for the data transportation between the Back Office systems and the Portal, through specific interfaces.

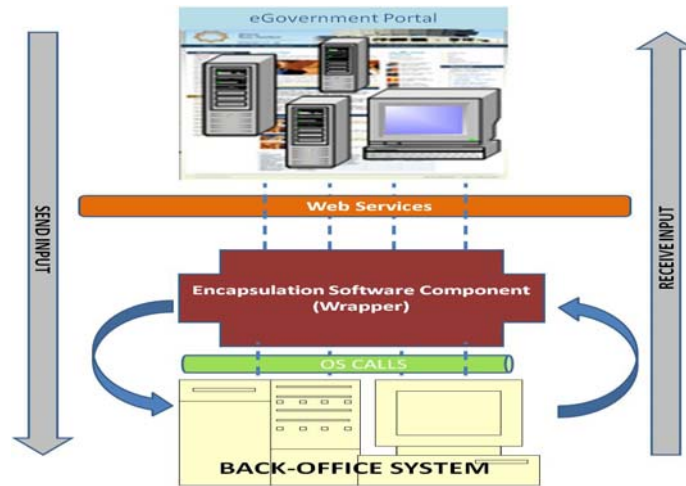


Fig. 3. Interoperability Layer Architecture

As depicted in Figure 3, only the required input and output interfaces, that became active during a transaction, are selected in a purely “follow the service” approach, from each back-office system. Those interfaces are connected with the Wrappers that facilitate the information flow to and from the portal with the use of Web Services [12]. In order to implement this architecture, the following steps are needed:

- Discover the inputs and the outputs of the back-office systems.
- Modeling the data that is transferred within the system using XML.
- Protocol and Communication channels development. This refers to the wrappers and the web services development by defining the communication ways with the back-office systems (.Net Calls, RPC Calls, Intermediate Tables, Direct DB Calls) and the portal (XML Schemas, Service Calls)
- Definition of workflow and application calls. The application call can either be triggered by the portal (in case of a request submission) but can also be triggered by the back office system itself (in case of a notification for a fee payment)
- Development of Security and Authentication mechanisms.

4. Application and Results

Taking into consideration that internet penetration and information technology’s application is still in low figures in Greece, and due to lack of technical expertise in public administration which are small or medium governmental organizations [17], it was essential to provide a complete solution, using cutting edge technologies and standards, which would ensure the proper and less demanding function of such systems in terms of maintenance and administrative operation.

The service portals implementation methodology was piloted in the Greek Urban Municipality of Ano Liossia, with almost 30,000 citizens and 1,000 businesses. Following the first steps of the methodology took not more than 5 weeks – a process that if followed in a standard “additive” way, usually requires some months.

The complete Standard Taxonomy was then transferred in a Commercially Available Content Management System, a Citizen Relationship Management system and a Workflow Management system. All these sub-systems were integrated in order to cooperate and act as the core system mechanisms for a prototype electronic services portal, offering information, identifying and authenticating users and managing the ongoing transactional process and data flow, which was successfully customized for the case of Ano Liossia.

Then, interconnections with back office systems were carefully modified, resulting in more than 30 electronic services at level-5 and level-4, and the rest at level-3 and level-2 –

hindered by the current legal status on validity of electronic certificates in Greece. The whole project was completed in not more than 5 months, which was considered a record time, given the capacity and readiness of the municipality systems and staff.

The implementation of the methodology resulted in important benefits for the Municipality of Ano Liossia, such as, faster communication with the citizens, faster completion of services provided to citizens and businesses, higher effectiveness referring to the operation of the municipality, complete record files, correct and transparent processes, reduced manual efforts and elimination of errors.

However, the case implementation elevated some important problems, which have to be faced in the future, in order to succeed fully interoperable electronic municipal services. These problems deal with the functional disintegration prevailing the current governmental structures affect the quality of the services provided via the e-Government portals, which in turn are often fragmented and departmentalized. Problems arise also from the wide gap and inconsistencies that exist between the perspective of policy makers and public administrations' managers, on the one hand and the technical realization of e-Government, on the other hand.

5. Conclusions

Various conclusions spring from the implementation of the Ano Liossia Electronic Services Portal and the application of the methodology:

- The implementation of Services Portals for municipalities has a lot to gain in time and effort to be spent, through the application of a rapid methodology which is based on Standard Service Taxonomies and interrelated information as well as on the construction of a prototype electronic services portal which can be customized according to the special conditions of every local administration.
- Greek Municipalities provide a large number of services involving many documents that are transferred during every service's process flow. The building of a standard services taxonomy containing the appropriate data is required, in order to record the necessary information and get the feedback for the next stages of the portal implementation.
- Although the multi-criteria analysis for categorizing the services in the respective e-government levels offers reliable results, legal and administrative issues should be taken into account in order to reach realistic results.
- The integration of the portal's sub-systems has to be independent of the technologies used for the development of the respective platforms.
- Generic patterns for interoperability should be identified for the cooperation between front-end and back-office systems. Moreover, the existing back-office data should be used not only for the transactions between the municipality and the citizens and enterprises, but for the validation of users as well.

Moreover, the methodology proved to be portable, with minor alterations to other countries with relevant municipal structure and service orientation; on-going work investigates potential application in municipalities in Czech Republic and Romania.

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