A Methodology for Developing Local Administration Services Portals

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Abstract: Two of the most active research fields in Information Technology nowadays are Internet Services Portals used by governmental organizations for carrying out transactions with the public, and Interoperability Patterns for achieving seamless cooperation of heterogeneous existing systems. When referring to e-Government applications in Local Administrations and Municipalities, the above research fields have to be tackled, as the resulting systems need to be functional, easy to implement, able to interconnect with back-office systems and citizen and employee friendly. This paper shows that the conceptualization, design, implementation and maintenance of Municipality Service Portals can be standardized, following a specific methodology. Piloted in a Greek Urban Municipality, the methodology 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 Service Composition taxonomies.

1. Introduction

Information Technology has nowadays turned its interest in the field of providing services for facilitating citizen's life. As a result, a major scientific movement is currently active in the fields of Internet Services Portals used by governmental organizations for carrying out transactions with citizens or enterprises and Interoperability Patterns for achieving the seamless cooperation of heterogeneous, front-desk and back-office public administration systems. The systems that are currently build or are taken into consideration for future development for local administration entities such as municipalities have to be examined in the deepest possible way as the outcomes should be functional, easy to implement and maintain, able to interconnect with the back-office systems. This way those systems would eventually server their main target which is no other than the facilitation of the citizens and the employees of those entities.

A complete, step-by-step methodology which will include and transform all the existing services of such an organization to electronic offered services is still missing. More specifically, all present methodologies fail to tackle issues such as the process categorization to the different levels of automation by constructing service taxonomies that will 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 will 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.

2. Objectives

This paper demonstrates that the conceptualization, design, implementation and maintenance of Municipality Service Portals can be standardized, following a specific methodology for these "SME's of eGovernment". With the use of such a methodology, a Municipality can quickly capture requirements, rate the importance of the various electronic services for the citizens and enterprises and proceed to the construction of an eGovernment portal by modeling and implementing the different process and data structures present in every service and by choosing the most appropriate complementary sub-systems for achieving interoperability with the underlying working systems and for offering to the public the features of a modern one-stop shop, such as user authentication, tracking of requests etc. As a result, the paper postulates that the local administration organizations, such as municipalities, can now follow this standard procedure for transitioning their traditionally conducted services to the new electronic environment, while also ensuring the usage of their existing back office systems

3. Technology Used

Piloted in a Greek Urban Municipality with almost 50,000 citizens and 3,000 businesses, the methodology comprises of (a) rapid process modeling with the use of BPMN-aware enterprise modeling tools, (b) CCTS-based (Core Component Technical Specification) data modeling in XML, (c) step-by-step adaptation of Content Management, Citizen Relationship and WorkFlow Systems, (d) SoA-enabled interconnections with the back-office applications and (e) overall guidance based on Service Composition taxonomies, containing more than 200 modeled services to citizens and businesses. [1]

Nowadays, various Frameworks such as (UK e-GIF[2], German SAGA[3], European Interoperability Framework (EIF IDABC)[4]) 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

Although all the above mentioned frameworks deliver detailed information and guidelines about central government systems, they fail to introduce specific in information and overall rules regarding local administration portals and services [5]. In this direction, the work presented in this paper comes as a methodology which will enlarge and complete such frameworks with typical architectures and generic local administration patterns for achieving interoperability at municipal level.

Many international standards and state-of-the-art modeling languages and technologies should be used in an e-Government portal as they preserve the feasibility, the accessibility, the accessibility and the security of the end product which is the portal. The most important of those are the following:

- Unified Modeling Language (UML), for modeling data components and forming widely accepted formatted documents.
- eXtensible Markup Language (XML), for modeling document data.
- XML Schema, for forming the XML Documents and introducing their generic formats
- The Core Component Technical Specification (CCTS), for building up the data structures from baseline and elementary data components

- Service-oriented Architecture (SoA) for enabling interoperability between the e-Government portal and the underlying back-office local administration systems.
- Web Services, with their respective underlying specific standards like Simple Object Access Protocol (SOAP) for data encapsulation and transport, Web Service Definition Language (WSDL) for service description Universal Description, Discovery and Integration (UDDI) , Web Services Flow Language (WSFL), Business Process Execution Language (BPEL), for modeling, orchestrating and implementing transaction flows using Web Services.

Moreover, other standards and technologies were also used which ensure the overall portal security and the compliance with the W3C standards for content accessibility and representation. Taking into consideration that in Greece and in other developing countries, where internet penetration and information technology's application is still in low figures, and due to lack of resources and technical expertise in public administration which are small or medium governmental organizations [1],[6], it is essential to provide a complete solution, using cutting edge technologies and standards, which will ensure the proper and less demanding function of such systems in terms of maintenance and administrative operation.

4. Methodology for Portal Design and Implementation

The work structure for implementing an e-Government portal does not differ a lot from similar IT projects. However, the nature of eGovernment portals implies a differentiation in the inner activities of the first work packages which deal with the initial modelling activities, which will offer the added-value to the end system. Those deal with the selection of the processes which will be offered electronically, the data and process modeling, the implementation of the interoperability layer and the interconnection of the various subsystems and the developed applications.

4.1 Service Analysis, Categorization and Selection

The first step, which leads the process modeling study, compromises of establishing a way for analyzing and selecting the Local Administration Entity's services towards the citizens and enterprises, in order to allocate in a complete and definite way the processes that are going to be automated through the portal [6].
The 4-level model adopted by the European Commission is adopted, stating four different levels for electronic services [7],[8] as presented in Figure 1. The services that the Local Administration Entities provide to citizens and enterprises shall be evaluated, aiming at the plotting of a map containing those services that are going to be provided to the public through the portal. During the evaluation the services are sorted by the life events towards the citizens, by the business episodes towards the enterprises and by several other parameters, such as the nature of each service (information, transaction, declaration, print of certificates), the targeted audience (citizens, enterprises, disabled persons, Local Administration Entity staff) and the way in which a service is provided (automated services and level of automation, support by other information systems).

The parameters that are used for the sorting and the evaluation of the services are [9]:
- Frequency of use , meaning the total request made to the corresponding office 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 the execution
- Support by 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 (e.g. interaction with police departments).
- Reliance on other Services, pointing out whether the service includes the execution of other services offered by the organization.
- Demand for onsite presence, e.g. if the natural presence of the applicant is required.

The above criteria are applied and scored for each of the 200 services discovered. The sorting and the evaluation of the scoring, which are done by applying multi-criteria methods, such as the ELECTRE TRI method, result to a classification table of those services, 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.
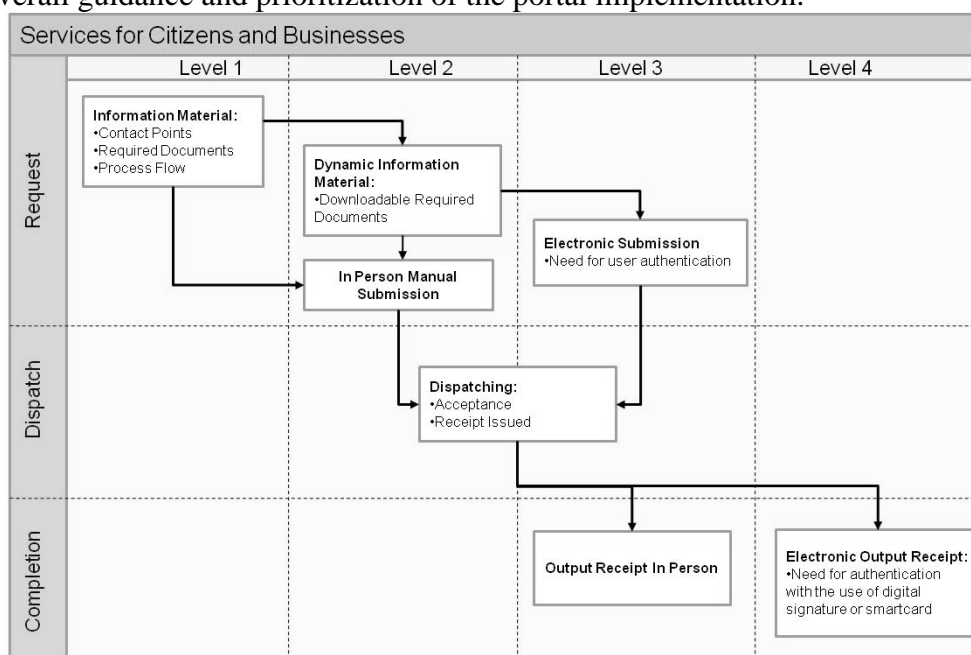

Figure 1: The service workflow, organized in the 4-Level model

4.2 Process Modeling

The Modelling phase is based on Business Process Modeling Notation (BPMN) which offers the direct extraction of executable code from the designed models using the Business Process Execution Language (BPEL). The process modeling captures the flow of the steps, inputs and outputs for every service described, resulting in a coherent representation of:
- The Local Administration 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 generated and exchanged.
- The various document exchange flows between the involved entities

The target of the above process modeling is 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 and level-4 processes by the Municipal Portal.

4.3 Data Modeling

None of the current European or National e-Government Interoperability Frameworks which were mentioned above – often characterized as the e-Government Bibles – has developed a universal language to describe the semantics of governmental data in unambiguous terms. Second, the development of 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, is observed in isolated cases, like United Kingdom's e-GIF Registry. As a result, the unification of governmental data models for facilitating the seamless exchange of information and the deployment of interoperable systems in Central, Regional and Municipal Government appears today as critical yet less touched issues that deserve more in depth exploration [10].

Core Components are generic business data components that belong to the UN/CEFACT Core Component Library (UN/CCL). 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 (e.g. postal address, personal information) that are syntax-independent and represent the general business data entities which are commonly used in today's business processes. The Core Component Technical Specification (CCTS) is the associated method comprising meta-models and rules for the semantically unambiguous definition of business information on a syntax-independent level.
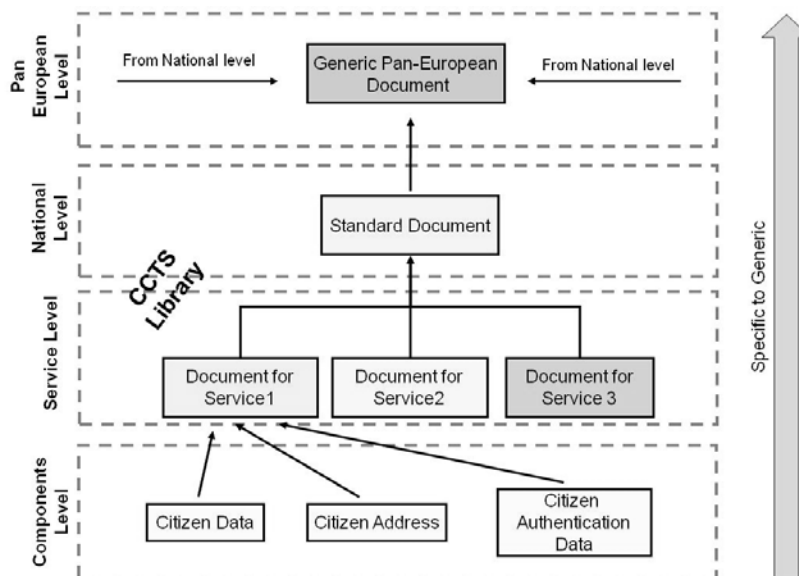

Figure 2: Creation of Standard e-Government Documents using a CCTS-compliant Methodology

The methodology for the data modeling follows the next five steps:
1. Study of the map of services to be automated
2. Record of all the necessary documents (service inputs or service outputs)
3. Elaboration of the documents in order to recognize the most frequent used structures, such as the citizens' personal data
4. Creation of core components, according to the Core Components Technical Specification (CCTS) methodology, for the most frequent used structures
5. Creation of standard input and output documents
6. Creation of generic pan-European documents by merging the different standard documents of the various national levels

4.4 System Architecture Design

Each modern portal implementation relies on a n-tier architectural solution as this approach offers great advantages such as the high grade of scalability of modules according to the portal needs [11], as the portal size and its functional requirements will guide the total implementation. Figure 3 describes the logical architecture of the system which contains parameterisable Common Off-the Self Components, 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. Moreover, the open source character enables the incarnation of various modules which offer services beyond level 2.
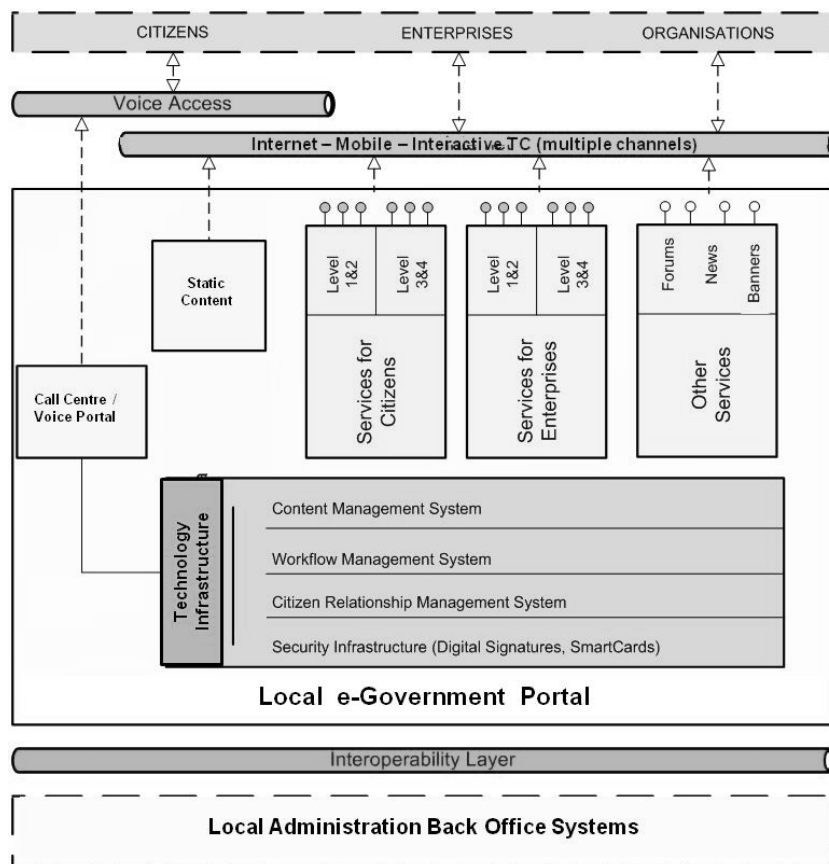

Figure. 3: Local administration Portal Architecture

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 opens 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, an important issue in e-Government portals [12]. The Workflow Engine – mostly responsible for managing the level-3 and level-4 services- offers the flexibility of adding, replacing and updating working processes, without requiring great code-writing efforts. Such engines can be used in order to tune each process actions by assigning roles, rules and necessary actions. Thus, 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 [13].

4.5 Interoperability Layer Implementation

Interoperability is the keyword which adds value to the e-Government portal by achieving the interconnection and the cooperation between heterogeneous systems. As the portal will operate as a front-end interface for the internet users, in order to be served by the Local Administration back-office systems, the layered named as "interoperability layer" is essential if services of level 3 and 4 are going to be offered through the portal. 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.

As shown in Figure 4, from each back-office system only the required input and output interfaces, that became active during a transaction, are selected in a purely "follow the service" approach. Those interfaces are connected with the Wrappers which facilitate the information flow to and from the portal with the use of Web Services [14],[16]. This approach enables the interconnection of the different subsystems and guarantees the high performance as only the required interfaces are used.
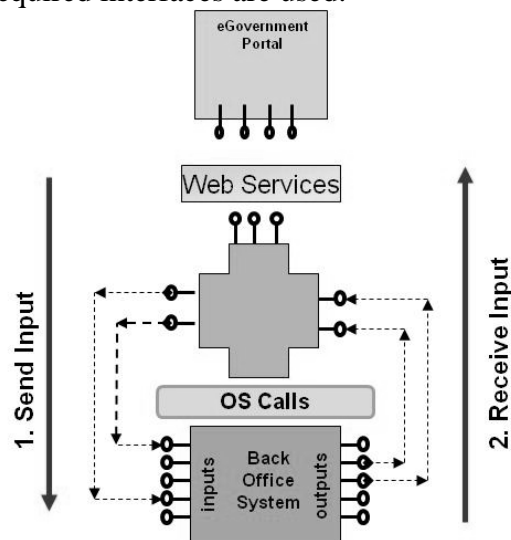

Figure 4: Interoperability Layer Architecture

In order to implement this architecture, the following steps are needed:
1. Discover the inputs and the outputs of the back-office systems.
2. Modeling the data that is transferred within the system using XML.
3. 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)
4. Definition of workflow and application calls. The application call can either be triggered by the portal (in case of a request submission) where the portal is initiating the call and waits for a reply but can also be trigger by the back-office system itself (in case of a notification for a fee payment)
5.   Development of Security and Authentication mechanisms.

5. Lessons Learned

The initial project was implemented in 8 months, a relatively short period of time. This duration was feasible because of the innovative methodologies used such as CCTS and BPMN process modelling, which have designed the high level architecture at a very detailed level ideal for successfully guiding the code developers whose main concerns were

to implement the services modules and achieve the interconnection with the back-office systems.

However, those costs and the duration of similar ongoing projects, based on the same methodology are even more decreased due to the reusable "methodology modules" which spring out from this methodology. Those are mainly focused on the modelling activities, as the services that are examined are at most cases identical, which is ideal for accelerating the modelling process as results are almost similar.

6. Conclusions

The main idea behind this paper is the creation of a complete methodology which would benefit Local Administrations and various organisations which participate in eGovernment movements for the rapid development of Portals, offering complete end-to end transactions to the users. Moreover, this methodology offers the possibility for the generation for positive actions and results like:

- The real problem set up as understood through citizens and businesses themselves which will be the eventually target groups and end users of such systems.
- The construction of a Generic a Reference Architecture for Public Administration Portals including customizable systems (CMS, CRM, WFMS, etc)
- Generic patterns and proposals for the interoperable operation of front office and back office systems
- Assist in the creation of Pan-European eGovernment Services (PEGS) at local and municipal level

Moreover, the methodology is further developed by its inclusion within the Greek eGIF (the municipality is a pilot municipality in eGIF) and is currently extended following the Greek eGovernment strategy in order to satisfy uprising requirements by its pilot implementation.

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