

# Building an eGovernment Services Portal for Local Administrations

Sotirios Koussouris, Fenareti Lampathaki, Georgios Gionis, Anastasios Tsitsanis, Yannis Charalampidis, Dimitrios Askounis.

National Technical University of Athens,  
9 Iroon Polytechniou st, Zografou-Athens, 157 73, Hellas  
{skoussouris,flamp,gionis,ttsits,yannisx,askous}@epu.ntua.gr

## Abstract

Two of the most active research fields in Information Technology nowadays are systems used by governmental organizations for carrying out transactions with citizens and technologies that facilitate the interconnection and interoperability of heterogeneous existing systems. When referring to eGovernment systems, those two research fields are joined and the end results are systems which can be seen as set-top boxes on the existing governmental systems. Those new generation systems are provided by governmental organizations, such as local administration entities and used by citizens for conducting their transactions with the state. This paper presents the standards, the technologies and the necessary activities that guide to the implementation of an interoperable eGovernment portal that offers automated services to the end users.

**Keywords:** e-Government, Interoperability, Local Administration Systems

## *1. Introduction*

The rapid development in Information Technology is nowadays opening new horizons regarding the facilitation of everyday life of computer users. As the Internet becomes a daily activity of people's life, more and more organizations tend to offer internet based services, replacing their traditional front-desk transactions. Following this trend, governmental organizations, such as 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 offer electronic flavored services as well, by promoting interoperability with the present underlying systems that are currently serving the public [Jaeger (2003)].

Local Administration Entities, such as municipalities [Capgemini (2006)], 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. The benefits that rise from such a portal are the following [Charalabidis et. Al. (2006)]:

- Alternative service channels for the citizens and enterprises such as Internet, Mobile phone access and also voice access with the use of Interactive Voice Response (IVR) systems.
- Optimization of the service levels as the on-site presence becomes unnecessary.
- Exclusive services for facilitating different groups such as disabled persons, the elderly, the youth, etc.
- Workflow optimization and automation in the highest possible degree by standardizing processes and documents
- Effective cooperation between different in-house departments of local administration, by intergrading and interconnecting services and processes that take part in common transactions

This paper presents a complete methodological procedure for setting up Municipality Service Portals which was successfully applied in a Greek urban Municipality with almost 50,000 citizens and 3,000 enterprises.

## ***2. Building e-Government Portals – Frameworks and Standards***

Municipal e-Government Portals, which will offer automated services and would address the public, it is essential to comply with international standards and system design techniques that should guarantee the end system's functionality and feasibility. This chapter presents the most important frameworks and standards that should be followed when designing and implementing e-Government Portals [Pavlichev et. Al. (2004)].

This chapter presents an Overall Methodology for the rapid development of local administration e-Government portals which consist of the following steps: (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 already modeled services to citizens and business.

### ***2.1 e-Government Interoperability Frameworks***

Various Frameworks are nowadays 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

The most known frameworks are the following:

- The UK Electronic Government Interoperability Framework (e-GIF)
- The German SAGA
- The European Interoperability Framework (EIF IDABC)

Although all the above mentioned frameworks deliver detailed information and guidelines about central government systems, they fail to introduce specific information and overall rules regarding local administration portals and services [Heeks (2003)]. 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.

## 2.2 Standards

International Standards and state-of-the-art Modeling Languages should be used in any e-Government portal as they preserve the feasibility, the accessibility, the accessibility and the security of the end product which is the portal.

**Data Related Standards and Technologies:** These standards are focusing in the data entities which are included and transferred within the portal. The standards to be considered are:

- 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
- Dublin Core Metadata Initiative for metadata description

**Process Related Standards and Technologies:** As the portal will provide automated services to the public, it is essential to identify and to model the underlying processes which will be inserted during the implementation phase to the portal. The end solution should be based on:

- Service-oriented Architecture (SoA) [Kreger (2001)] 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) [18], Web Services Flow Language (WSFL) Business Process Execution Language (BPEL), for modeling, orchestrating and implementing transaction flows using Web Services [Stojanovic et. Al. (2005)].

**Security and Authentication Standards and Technologies:** Security is at outmost importance for such a system, as the transferred data are quite sensitive and the services offered should be defended from malicious users and intruders. Therefore, cutting-edge technologies are considered, that guarantee the data integrity and the fraud-free operation of the system. Those technologies include:

- Cryptography, (symmetric cryptography, asymmetric cryptography, Public key cryptography (Rivest-Shamir-Adleman (RSA) algorithm), Digital Signatures) [Blanchette et. Al. (1998)]
- Internet Protocol Security, a developing OSI-Layer protocol which includes protocols like Secure Sockets Layer (SSL), TLS (Transport Layer Security)
- S/MIME (Secure Multi-Purpose Internet Mail Extensions)
- Firewalls
- HyperText Transfer Protocol Secure – HTTPS
- Public Key Infrastructure (PKI)

**Other Standards:** Apart from the above mentioned standards, an e-Government portal should also respect other standards as well, mainly for the presentation of the context, based on the World Wide Web Consortium (W3C) specifications. The Web Accessibility Initiative (WAI) is such a standard which aims at disabled people facilitation for accessing internet based systems.

The presented approach is demonstrating the application of the above standards in the local / municipal level. This specific effort, in Greece and in other developing countries, where internet penetration and information technology's application is still in low figures, is a very demanding context, due to lack of resources and technical expertise in public administration which are small or medium governmental organizations [Charalabidis et. Al. (2005)]. Therefore 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.

### ***3. Portal design, implementation and support***

As with any information system, the work structure for deploying an e-Government portal does not differ a lot from similar projects. However, there are some work packages which should be considered of highest importance, as they are the ones

offering the added-value to the system and are essential for the fruitful operation of the portal. 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.

### ***3.1 Service Analysis, Categorization and Selection***

Prior to the process modeling study it is essential to establish 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 [Lee et. Al. (2005)].

As a start, the 4-level model adopted by the European Commission was adopted, stating four different levels for electronic services [Layne et. Al. (2005)]. Those 1 are:

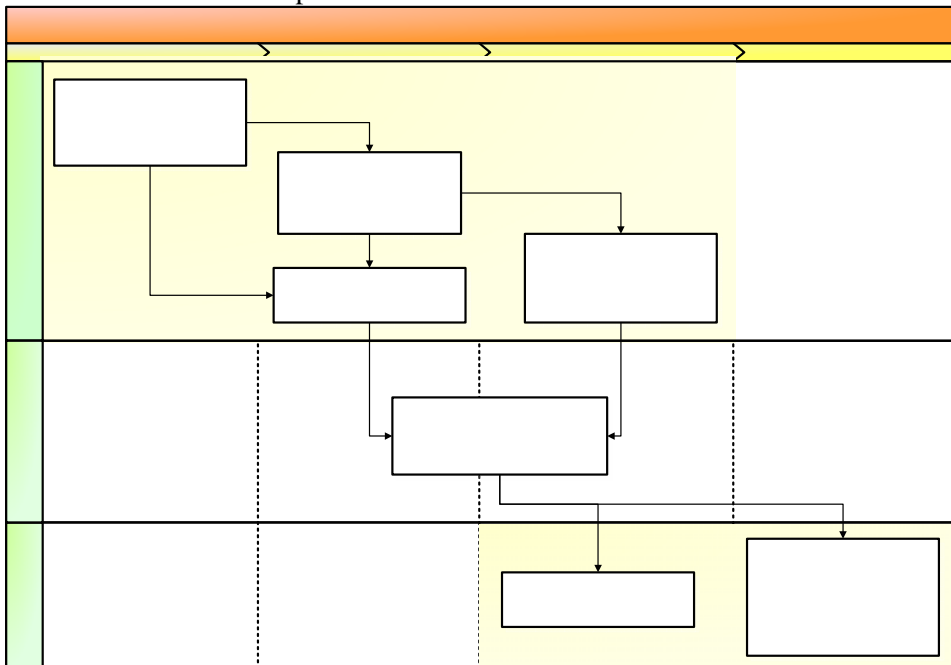
- **Level 1 - Information:** This level contains only information about the corresponding service.
- **Level 2 - One-way interaction:** A 2nd level service provides to the end user downloadable material, such as .pdf forms or similar documentations which have to be filled in by the user and handed to the corresponding office.
- **Level 3 - Two way interaction:** This level provides on line tools where a user can fill in his request and initiate the process of the transaction. For completing the transaction, the end user must appear at the service office and collect his receipt. Services offered in level 3 require the authentication of the user.
- **Level 4 - Transaction:** Services in the 4th level are fully automated and the end user gets the service's output in electronic format, after imitating the transaction. Such services include steps as authentication, decision, notification and delivery of receipt.

The services that the Local Administration Entities provide to citizens and businesses 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, after being categorized in the four-level model, 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:

- 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 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



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

The above criteria are applied and scored for each of the 200 services. The sorting and the evaluation of the scoring, which are done by applying multi-criteria methods, such as the ELECTRE TRI [Mousseau et. Al.] 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.

### **3.2 Process Modeling**

State-of-the-art modeling notations and methodologies have been selected for the process modeling phase. Namely, the Business Process Modeling Notation (BPMN) has been used in order to extract 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.
- 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.

### **3.3 Data Modeling**

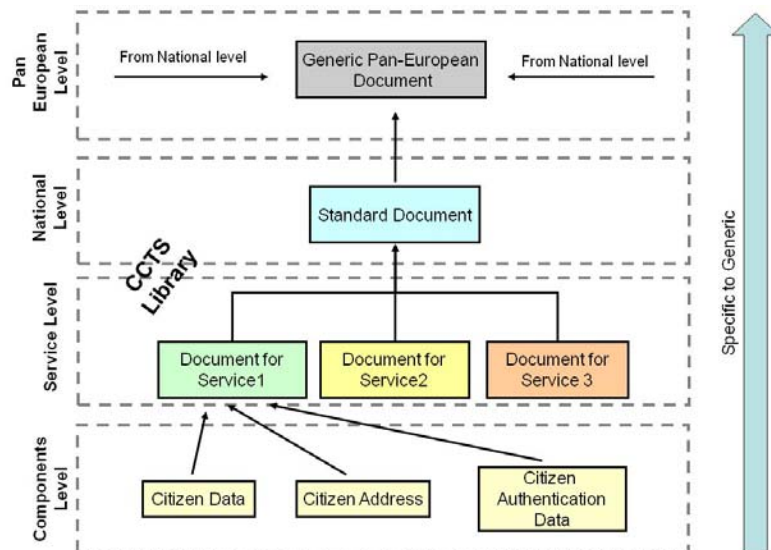
Unified governmental data models for facilitating the seamless exchange of information and the deployment of interoperable systems in Central, Regional and Municipal Government appear today as critical yet less touched issues that deserve more in depth exploration [Janner et. Al. (2006)]. None of the current European or National e-Government Interoperability Frameworks – 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.

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 (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. The UN/CEFACT Naming and Design Rules (NDR) define a set of guidelines for transforming CCTS based artifacts into XML Schema and XML based instances.

The methodology for the data modeling follows the next five steps:

- i. Study of the map of services to be automated
- ii. Record of all the necessary documents (service inputs or service outputs)
- iii. Elaboration of the documents in order to recognize the most frequent used structures, such as the citizens' personal data
- iv. Creation of core components, according to the Core Components Technical Specification (CCTS) methodology, for the most frequent used structures
- v. Creation of standard input and output documents
- vi. Creation of generic pan-European documents by merging the different standard documents of the various national levels



**Figure 2.** 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). This particular approach allows the scalability of modules according to the portal needs, as the portal size and its functional requirements will guide the total implementation. Moreover, the sorting of operations in distinctive levels in order to avoid unequal burdens of particular sources, or of the whole system



is also guaranteed by the n-tier architecture chosen and last but not least this architecture offers the option of selective expandability.

Figure 3 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 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. Other systems are Workflow Engines – mostly responsible for managing the level-3 and level-4 services flow, Citizen Relationship Management Systems and IVR Systems for enabling voice access.

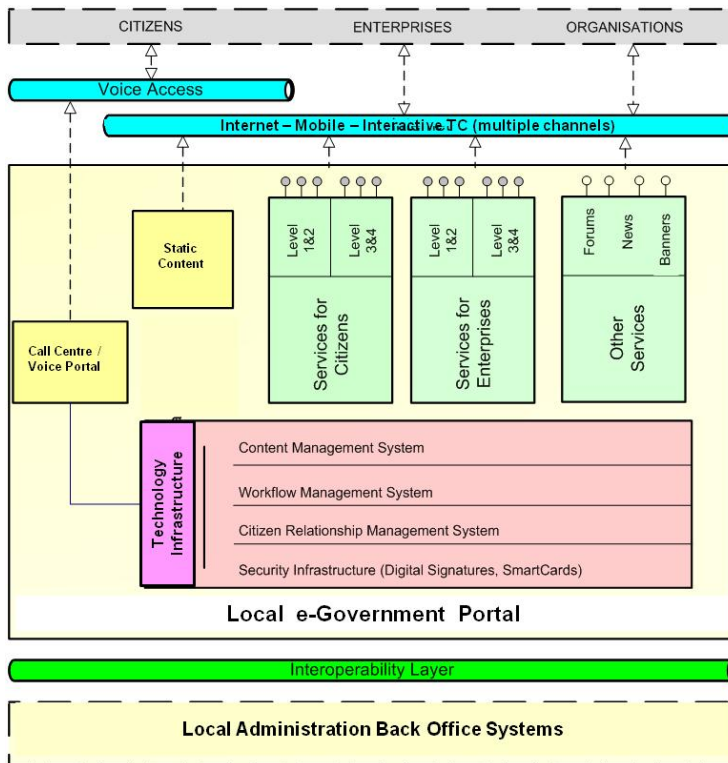


Figure 3. Logical Architecture of the System

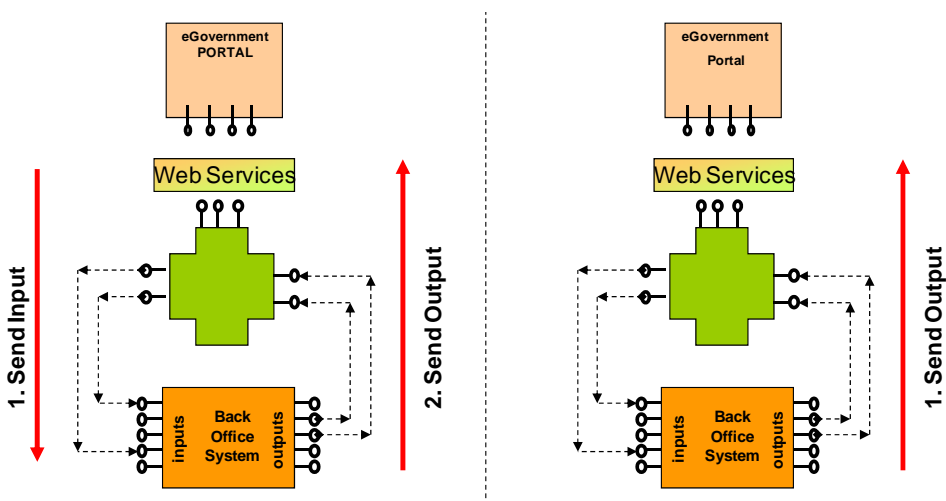
The Content Management Platform the Citizen Relationship Management System (CRM) and the Workflow Engine all cooperate as the core transactional components of the system. The CRM serves the user authorization and identification and tracks down all user activities, namely from simple queries or questions asked, to 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 [Medjahed et. Al. (2003)].

Finally, the Workflow Engine 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 [Vassilakis et. Al. (2003)].

### 3.5 Interoperability Layer

The interoperability layer is essential for the e-Government Portal, if services of level 3 and 4 are offered to the public. 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. As those systems are of different technologies and of different generation, interoperability is the key which adds value to the e-Government portal by achieving the interconnection and the cooperation between heterogeneous 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.



*Figure 4. Interoperability Layer Architecture*

As depicted 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 [Soon et. Al. (2002)]. This approach enables the interconnection of the different subsystems and guarantees the high performance as only the required interfaces are used.

In order to implement this architecture, the following steps are needed:

- i. Discover the inputs and the outputs of the back-office systems.
- ii. Modeling the data that is transferred within the system using XML.
- iii. 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)
- iv. 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)
- v. Development of Security and Authentication mechanisms.

#### ***4. Conclusions***

The paper presents an overall methodology which is aiming at the automation of the complete set of services offered by a governmental administration in local administration level. The whole methodology was piloted in the Greek urban Municipality of Agia Paraskevi with very positive initial results, both from the employees and the citizens. Reusable patterns and methods springing from this holistic approach are:

- The real problem definition, based on the formal description of almost 200 services to citizens and businesses, using process and data modeling tools, assisting in the creation of Pan-European e-Government Services (PEGS) at local and municipal level.
- Prioritisation of services, based on their impact on citizens and businesses.
- The construction of a Generic a Reference Architecture for Public Administration Portals including parameterisable systems (CMS, CRM, WFMS, Security Infrastructures) and be-spoke components.
- Utilisation of the CCTS methodology for defining the needed XML documents.
- Service-driven components for the interoperable operation of the portal with back office systems

Moreover, the methodology will be further developed by its inclusion within the Greek e-GIF (the municipality will also be a pilot municipality in eGIF). Furthermore, as the current Greek e-Government strategy targets a wide area of

public administration organizations, the presented approach will be extended in order to satisfy all uprising requirements as portals are built for larger municipalities.

## References

- Blanchette, Johnson, (1998), *Cryptography, data retention, and the panopticon society*. Computer & Society. vol 28(2), p1–2
- Capgemini, (2006), *Online Availability of Web Public Services: How is Europe progressing? Web based survey on Electronic Public Services*, Report of the Sixth Measurement
- Charalabidis, Askounis, Gionis, Lampathaki, 2006, *Organizing Municipal e-Government Systems: A Multi-facet Taxonomy of e-Services for Citizens and Businesses*, EGOV 2006
- Charalabidis, Gionis, Lampathaki, Askounis, Metaksiotis, (2006), *Organising Municipal e-Government Systems: A Multi-Facet Taxonomy of e-Services for Citizens and Businesses*. eGov Conference 2006. Krakow Poland
- Heeks R., (2003), *Most e-Government-for-Development Projects Fail: How Can Risks be Reduced?*, IDPM
- Jaeger P., (2003), *The endless wire: E-government as global phenomenon*, Government Information Quarterly vol. 20
- Janner, Lampathaki, Mouzakitis, Scheper & Schroth, (2006), *Interoperability enhancement of electronic Business-to- Government: Extending the scope of UBL*. PAKM Workshop. Vienna
- Kreger, (2001), *Web Services Conceptual Architecture (WSCA 1.0)*. IBM Software Group
- Layne, Lee, (2001), *Developing fully functional E-government: A four stage Model* Government. Information Quarterly 18
- Lee S., Tan X., Trimi Silvana, (2005), *Current practices of leading e-government countries*, Communications of the ACM archive, vol. 48
- Medjahed, Rezgui, Bouguettaya, Ouzzani, (2003), *Infrastructure for E-Government Web Services*. IEEE Internet Computing. vol 7
- Mousseau V., Slowinski R., Zielniewicz P., *ELECTRE TRI 2.0a, User documentation*", Université de Paris-Dauphine, Document du LAMSADE
- Pavlichev, Garson, (2004), *Digital Government: Principles and Best Practices*. IDEA Group Publishing
- Soon A. C., Vijayalakshmi A.Nabil A., (2002), *Dynamic composition of workflows for customized e-Government service delivery*, ACM
- Stojanovic, Apostolou, (2005), *Ontology-based Change Management of e-government services*, WI2005 Conference
- Vassilakis C., Laskaridis G., Lepoura G., Rouvas S., Georgiadis P., (2003), *A framework for managing the lifecycle of transactional e-government services*, Telematics and Informatics, vol. 20