

Paving the way to eGovernment Transformation: Interoperability Registry Infrastructure Development

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Abstract. During the last decades eGovernment has been a vivid, dynamic research and development area. As services are being transformed, electronic documents and web services appear every day in many countries, the involved stakeholders are in urgent need for an instrument to structure governmental administration processes, service composition and provision - in a way that eGovernment transformation can be constantly managed. This paper presents the creation of an eGovernment ontology, and the development of a knowledge-based registry of governmental services in Greece. This Registry is an advanced web portal, devoted to the formal description, composition and publishing of traditional, electronic and web services, including the relevant electronic documents, information systems and as well the process descriptions and the work-flow models in an integrated knowledge base. Through such a repository, the discovery of services by users or systems has been automated, resulting in an important tool for achieving interoperable eGovernment transformation.

Keywords: eGovernment, Registry, Ontology, Knowledge Management, Semantic Interoperability

1 Introduction

Today, Public Administrations are striving to leverage modern information and communications technologies to improve the quality of their services to citizens and businesses, to provide multiple communication channels and to make their internal and cross-organization operations more efficient, even if this requires changing their modus operandi. In order, though, to fully realize the e-Government potential for productivity growth, it is not sufficient to modernize the front office by offering public services over the internet through e-Government portals [1]. The e-Government era implies fundamental knowledge redistribution and requires a careful rethinking of the management of information resources and knowledge bases [2]. Ample access to remote information and knowledge resources is needed in order to facilitate:

- Citizens' and businesses' oriented service delivery including one-stop service provision,
- Inter-organizational co-operation among governmental agencies

- Cross-border support for complex administrative decision making.
- Limit the loss of critical knowledge assets during the life cycle of e-Government services

The concept of knowledge management (KM) is not new to the public sector; either intentionally or unintentionally, KM initiatives have always been integrated in government tasks, inseparable from strategy, planning, consultation and implementation [3]. More and more governments are realizing the importance of KM to their policy-making and service delivery to the public and some of the government departments are beginning to put KM high on their agenda. Societal responsibilities, for delivering public policy that benefit the common good further enhance the importance of effective KM in public services [4].

In this context, the use of eGovernment Registries can enhance the access to and delivery of governmental knowledge, information and services to the public and other governmental agencies and bring about improvements in government to operations that may include effectiveness, efficiency, service quality or transformation.

This paper presents an ontological approach of developing an eGovernment Registry in the context of the Greek eGovernment Interoperability Framework, following the structure below: In the second chapter, a state of the art analysis around ontologies and repositories for eGovernment is conducted. The proposed eGovernment Ontology is introduced in chapter 3. Chapter 4 outlines the Interoperability Registry Platform leading to chapter 5 that dives into more detail regarding the eGovernment Services Registry. In chapter 6, the first results of the Registry's population are presented leading to conclusions / further work in chapter 7.

2 Ontologies and Repositories for eGovernment

In the span of this work related research efforts on Ontologies for eGovernment-aspects were examined and reviewed. The main findings upon which our approach builds originate from the following relevant work:

- Ontologies for the description of e-Government knowledge [5] and the guidance in the design of e-Government portals [6]
- Ontologies describing organizations and individuals participating in a government R&D programs [7]
- Ontologies analyzing Government Concepts Used in the CIA World Fact Book 2002 [8]
- Ontologies developed or being developed in the context of EU-funded Research Projects in the area of e-Government, like the DIP e-Government Ontology [9] and the OntoGov E-Gov Lifecycle Ontology [10], in Legal Issues, like the Estrella Legal Knowledge Interchange Format [11] and LEX-IS Ontology for Legal Framework Modelling [12], and in Data Modelling [13]
- Ontologies for e-Government public services that have emerged from research like [14] and Arianna [15]
- UK Government Common Information Model (GCIM) [16] as a high-level information model for all activities undertaken by the public sector

- Governance Enterprise Architecture (GEA) [17] that includes a set of domain models describing the overall governance system and serving as a top-level enterprise architecture

State of the art in Registries and Repositories for the public sector typically falls within the jurisdiction of the current European or National e-Government Interoperability Frameworks. In most cases, however, such repositories try to cover the semantic aspect of interoperability with XML schemas for the exchange of specific-context information throughout the public sector within the country borders and do not interfere with service descriptions or web services deployment. For example in the European Union:

- The United Kingdom has developed the XML Schema Library [18], containing approximately 78 XML Schemas.
- Denmark has designed the InfoStructureBase system [19], including an international standards repository with business process descriptions, data-model descriptions, interface descriptions, complex XML schemas and schema fragments (information object) from public and private organizations and an UDDI repository containing information on web services.
- Germany has the XML Infopoint [20], where information on planned, current and completed projects with an XML reference is gathered, and is to be replaced by the oncoming XML Repository, a central point providing data models for reuse.
- In Italy, one can find a similar approach in Arianna project [15], which has defined an ontology for e-Government public services and deployed a repository containing service descriptions mainly at local level.

Gaining knowledge, best practices and lessons learnt from the above similar but partial attempts, Greece has deployed such an infrastructure that can effectively support the interoperable operation of governmental systems through providing for service composition, discovery and use in a utility-like way, as presented in detail in the following chapters.

3 The Proposed eGovernment Ontology

The eGovernment Knowledge Interoperability Ontology (eGKI) is a two-layer ontology, aiming at capturing and interconnecting the knowledge elements to be met during manual or electronic services provision to citizens or businesses. The Ontology consisting of 37 classes, 131 datatype properties, 83 bidirectional object properties (reflecting the relations between the classes) and more than 60 restrictions. It is formalized using OWL [21], since it is a standard language for representing ontologies on the web. The ontology has been developed using open source ontology editor, namely Protégé [22] and has been successfully checked for inconsistencies using the trial version of the Description Logic Reasoner RacerPro [23].

Each layer of the ontology is related with a different level of abstraction concerning the modeled concepts and relations between concepts. The top layer is the most abstract, while the bottom layer incorporates more technical details.

3.1 The Top-Layer eGKI Ontology

The eGKI Ontology includes the definition and the representation of the following basic entities – classes:

- Services provided in conventional or electronic means by the public authorities to the citizens and businesses.
- Documents, in electronic or printed format, that constitute the inputs or outputs of a service or are involved during their execution.
- Information Systems, which encompass the web portals as well as the back-office and the legacy systems.
- Public Administrations that embrace all the service points and the authorities of the public sector.
- Web Services for the interconnection and the interoperability among information systems.

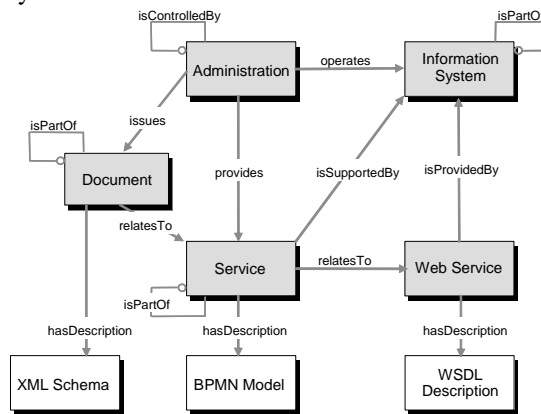


Fig. 1. The top level of eGKI Ontology

As depicted in Fig. 1, the entities are also connected to BPMN descriptions, XML Schemas or WSDL files for the analysis of services, documents and web services. The eGKI Ontology also analyzes and incorporates concepts, like the Core Components specification [24], the Code Lists for Public Administrations and Countries, for example.

3.2 The Bottom-Layer of eGKI Ontology

The bottom-layer of eGKI Ontology encapsulates all the aspects related to e-Government Services composition and execution. In principle, the lifecycle of an e-Government service starts when a citizen or a business or a public administration triggers the generation or the change of a service. In order to provide a service, a public administration needs to have a high-level view of the service model, links to related laws, resources involved and inter-relations with other services. In more detail in the eGKI ontology:



Fig. 2. The bottom level eGKI Ontology in Protégé

A service can be provided in a conventional way (becoming an instance of the class *Service*), by electronic means like web portals or cell phones (thus instance of the class *Electronic_Service*) or as web service incorporated in back-office systems and applications (attributes of class *Web_Service*).

The class *Document* contains the information that is related to a manuscript or electronic document that emerges as input or output of a service, is involved in the execution of a service or is deliverable of a project. The class *Structured_Document* contains the document - related information together with the analysis of the document fields and the XML Schema definition.

The class *Public_Organization* embraces any governmental authority, from ministries and prefectures to municipalities and other governmental organizations.

The class *Information* reflects the informational material that is associated with a service.

The class *e-Gov_Extended_Entity* is broad and generic, usable for describing a wide range of resources, apart from the entities (service, document, public body and information system) that have been specified in the other classes of the parent class *e-Gov_Core_Entity*.

The class *Information_System* contains details about the information systems that support the everyday operation of public bodies and their transactions.

The class *XML_Data_Entity* refers to data which is structured in XML syntax, like Code Lists, XML Schemas and the Components and Data Types on which they are based. A Core Component Entity has the subclasses *Basic_Core_Component* and

Aggregate_Core_Component that identify whether a data field in a XML Schema is simple or complex. The classes Basic_Government_Information_Entity and Aggregate_Government_Information_Entity inherit from and extend the classes Basic_Core_Component and Aggregate_Core_Component, respectively. The siblings of the class Data_Type_Entity distinguish between Unqualified_Data_Type and Qualified_Data_Type on the basis of whether they impose additional restrictions on the approved core data types.

The class Legal_Entity and its subclasses capture the information of the legal and statutory framework for service provision (e.g. Legal Frameworks, Legal Elements, Rules, etc).

The class Physical_Entity identifies the individuals or businesses that participate in a service and can be extended in the public servants that are employed in a public organization.

Specific metadata in the form of data properties are inserted for the e-Gov_Core_Entity class and its subclasses as prescribed in the Documentation Model of the Greek eGovernment Interoperability Framework [25]. The datatype properties of the XML_Data_Entity and its siblings align with the UN/CEFACT Core Components Technical Specification [24]. An example of the aspects of a service incorporated and extended in the eGKI ontology has been presented in [26, 26].

4 The Interoperability Registry Platform

The architecture that implements the Interoperability Registry comprises of three layers: (a) the Web-based and UDDI (Universal Description, Discovery and Integration) interfaces for various groups of users, (b) the tools layer including ontology management, process and data modelling and (c) the information repository for interconnected data elements, process models, XML schemas and Web Services descriptions. These three layers, as shown in Figure 3, are integrated through a relational database engine (based on Microsoft SQL Server) and common access control and application engine integrating the tools level with the various interfaces.

The front-end platform components are as following:

- The Interoperability Framework Web Site found within the Greek eGIF Web Site [25], which publishes the various documents of the eGovernment Framework but also gives access to citizens and businesses for publicly available data.
- The Services Registry, accessible to authorized users that gives access to the Registry Tools (meta-data management, process and data modelling). The representation of the Services Registry is mainly the scope of this paper and the system will be extensively described below.
- The Registry UDDI interface, where administrations publish their Web Services or find existing, available Web services to use through their information systems, constructing truly interoperable, one-stop services.

The Tools layer comprises:

- The process modelling facilities, based on ADONIS modelling engine.
- The XML Management facilities, based on ALTOVA XML Authorware.

- The custom-developed ontology management, data entry and reporting tools that integrate all representations and models. This is the software implementation of the Services Registry and will be thoroughly discussed in the next section.

Finally, the Data Storage layer incorporates an aggregated database for the ontology instances as eGovernment elements, the Web Service descriptions in WSDL, the process models and the XML schemas and Core Components.

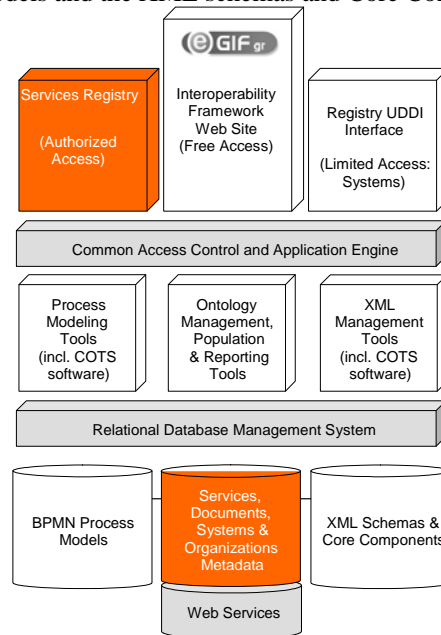


Fig. 3. Platform Architecture

5 Developing the eGovernment Services Registry (eGSR)

The mission of the Services Registry developed is to facilitate the eGS ontology integration into an intelligent and scalable software tool. In order to provide an automated methodological process and data modelling for eGovernment services, an ontology-based intelligent web information system is necessary. For it, the portal implemented as an eGovernment Services Registry (eGSR) offers simple data entry and management, facilitates electronic data automated imports with custom system modules, and also allows different user groups to be aware of the public sector administration and services provision through a wide range of simple, complicated and statistical reports. The target audience of eGS Registry includes the Ministry of the Interior, Public Administration and Decentralization (as the Registry Authorized Monitor), every Public Body that provides any type of governmental services, and ultimately citizens and enterprises as beneficiaries of the registered services.

5.1 Users and Rights

Services Registry has been implemented as an easy-to-use and useful tool in order to capture and manage huge information volumes. From a usability perspective, five types of users can be distinguished:

- Administrator: responsible for the users' rights and roles management, the data updates tracing.
- Super Users: responsible for publishing the adequate information in the Registry, verifying the reliability of the information provided by Public Bodies.
- Public Sector Employees: users who are in charge of providing specific governmental services and they have access only to data related to these specific services and the public body they work for. Except for querying, they have the right of editing and reformulating these specific data. Each update of these has to be approved and confirmed by the super users.
- Registry Monitors: they are senior managers of the Ministry of the Interior, Public Administration and Decentralization, responsible for the healthy use of the Registry and the published data conformity to the related legal framework. Super Users are accountable for the whole system performance and use to the Registry Monitors.
- Citizens /Enterprises: they have free read - access to main data of services, documents and public bodies only for informational and service provision beneficial reasons.

5.2 Data Entry Forms and Reporting

The platform provides standard management functionality (create, edit, delete) for all the main and secondary eGovernment elements, each of which corresponds to menu item. Thus, the items of the elements' management menu are Services, Public Bodies, Documents, Document Fields, IT Systems, Websites and Other Elements such as Projects, Addressees etc. Users can list all the available elements, view the details of any element (meta-data, properties, versioning, constraints etc), search for a defined element and of course create, update and delete an instance. In order to find an element the user is asked to provide search words describing the entity or its properties s/he wants to search for. Authorized users can create, edit and delete instances of the eGovernment elements via details-view web forms. Such a web form of Service Editing is depicted in Figure 4, representing all the meta-data, relations with other elements and attached files, which characterize a governmental service. The attached files can be text-based descriptions, BPMN models, XML files etc.

Furthermore, the Registry offers text-based structured reports and also advanced statistical spreadsheet reports. Users are one click away from producing several types of reports through simplified forms or advanced complicated query combinations. There are three main categories of reports provided by the registry.

- Type A (Main Elements Reports): simple or advanced reports related to the main elements of the Registry, representing requested properties, relations etc.

Authorized or anonymous users (with limited data access) can choose among a plethora of criteria and also select the details' level which s/he is interested in.

- Type B (Integrity Control Reports): a specific type of reports which have a notifying role for the integrity and in/completeness of data, relations and constraints stored and represented in the Registry.
- Type C (Sophisticated Reports): complex reports representing indirectly derived results and statistical information crucial for further eGSR data utilization and public sector further development and improvement.

5.3 Technical Implementation

The eGSR (eGovernment Service Registry) portal described above has been done by using the latest web programming techniques. The Web Interface has been developed with ASP.NET 2 web application framework running in integrated mode on Internet Information System 7.0. The DBMS used in the development of this system is SQL Server 2005. SQL Server 2005 has been chosen for its performance and scalability as one of the last trends in database development.

In the pilot operation of the Registry, the DBMS was located at the same machine as the web server was, because the limited user access rate in this first stage. As the access rate has been increased, the DBMS has been set in a dedicated computer. Still though, as the popularity and the overall usage of the portal have exceeded the expected levels, the portal suffered from an extremely low responsiveness. The main reason for this problem was the highly enriched graphical user-interface of the portal that on the one hand it may offer many useful controls and utilities that facilitate its usability but on the other hand slowed down its performance. In order to increase the portal's efficiency, an HTTP compression filter was enabled to make better use of available bandwidth. Data is now compressed before it is sent from the server and compliant browsers will decode the data on the client side. Moreover, there has been a significant effort to configure the Session object in the most efficient way, since it was the main reason that the portal sent too many data to the client. The first step was to create a page adapter that simply returned an instance of the session object rather than the default class which stores the viewstate in a hidden field on the client. Now as requests come in from any type of browser it uses the new adapter which returns a session instance. In this way, the viewstate is no longer stored on the client and therefore the portal's responsiveness was drastically increased.

6 Population of the Registry

Initial Population of the Services Registry has been greatly assisted by the existence of data in electronic form, through the Greek Ministry of Interior and was achieved through the following automated and semi-automated activities:

- Automated import of more than 1,797 public bodies including ministries, prefectures, districts, municipalities and public sector organizations

The screenshot shows a 'Service Edit' form with the following sections:

- GENERAL INFO:** Title (Family Driver Certificate Issuing), Identifier (0002), Is a Generic Service (Yes), Based on Generic Service (n/a), Is Final Service (No), Category (Family), Type (Certificate Issuing), Providing Public Body (Municipality), Business Event (n/a), Life Event (n/a), Authorizing Statute (FEE n. 9 896/14.07.2002).
- MANUAL SERVICE PROVISION INFO:** Demand on Presence in Submission (Yes), Demand on Presence in Reclamation (Yes), Manual Authentication Type (Identify Card OR Passport).
- ELECTRONIC SERVICE PROVISION INFO:** Website (http://www.kap.gov.gr), Provision Method (Browser), Current Electronic Provision Level (Level 3: Two-way interaction), Target Electronic Provision Level (n/a), Multilingual Content (Yes), Offer Provision Potentially (No), We. He Dispatch Potentially (Yes), Project Monitoring Support (No), Electronic Authentication Type (Username / Password).
- DIGITAL AUTHENTICATION FRAMEWORK INFO:** Data Type (n/a), Trust Level (n/a), Authentication Level (n/a), Authentication Mechanism (n/a), Registration Level (n/a).
- SERVICE GUARANTEE INFO:** Frequency (Transactions number / Year), Informational Policy (Yes).
- SERVICE REGISTRATION INFO:** Information Source (http://www.kap.gov.gr/...), Date of last Update (14/02/07), Data Completeness Status (Full).

At the bottom, there is an 'ATTACHMENTS' table and an 'ADD NEW' button.

Title	Version	File	Date Uploaded	Date Updated	User Uploaded	User Updated
EDS Descrip	BPMN	1.0	0002_82984.doc	12/9/2009	12/9/2009	EDU
EDS Descrip	Visual	1.1	0002_82984.doc	12/9/2009	12/9/2009	EDU
EDS Descrip	Visual	1.1	0002_82984.doc	12/9/2009	12/9/2009	EDU

Fig. 4. Service Data and Meta Data Editing

- Automated import of 1,009 governmental service definitions, with core metadata descriptions and frequency indications, stemming out of 3,000,000 service requests by citizens and businesses during the last year
- Modelling of the initial core 109 governmental services (including all i2010 services and the services amounting to 85% of the yearly service requests) and of the following 360 services and automated import of them in the Registry related to the corresponding service definitions
- Modelling of 1,111 documents with data fields descriptions for 300 of them
- Design of the 90 core XML schemas and automated import of them in the Registry related to the corresponding document definitions
- Modelling of 10 web services and 76 IT systems and portals with their corresponding metadata descriptions

The Registry is now being maintained and further populated with the assistance of engaged public bodies.

7 Conclusions and Future Work

The structured ontological knowledge base and the intelligent meta-data registry presented in this paper introduce a new automated approach towards eGovernment transformation ensuring interoperability by design, rework or change. The common

understanding and the explicit eGovernment knowledge ensured by the proposed approach bridge the gap between decision making and technical realization of e-Gov services while supporting all phases (design, configure, deploy, run) in the lifecycle of e-Gov services. Further benefits of the proposed approach include supporting the management of changes in e-Gov services (preserve consistency, detect inconsistencies, propagate changes, implement changes).

The approach adopted has addressed a number of key issues, such as:

- a. Definition of the eGS Ontology and Metadata Definitions for all core elements in the eGovernment domain.
- b. Implementation of the web eGSR portal based on the eGS ontological knowledge, as a useful and easy-to-use software semantic modelling tool, with different security levels and targeted multiple user groups.
- c. Integration of BPMN models, XML data models into the eGSR.

The initial application of the system, as well as the relevant evolutions from other European eGIF's, are indicating that such new perspectives should be taken into consideration in eGovernment Frameworks from now on [**Error! Reference source not found.**].

Along the Greek eGIF and the eGS Registry a lot of future work has to be done including both organizational and technical tasks, since the proper maintenance and usage of the registry is now the crucial issue. So, efforts will be targeting the following objectives:

- Binding with the Central Governmental Portal for citizens and businesses, so that the registry can merit the appropriate use of anonymous users, beneficiaries of most of the governmental services.
- Initial training of key staff within public bodies for using and extending the registry.
- Engagement of the public servants; more effort is to be put towards encouraging stakeholders to interact with the registry and among themselves, building synergies across the public sector authorities in a truly interdisciplinary way – hopefully leading in the next definition of the registry e-participation functionalities.

References

1. Apostolou D., Stojanovic L., Pariente Lobo T., Casas Miro J., Papadakis A.: Configuring E-Government Services Using Ontologies
2. European Commission (1998). Public sector information: A key resource for Europe, Available at: http://mineco.fgov.be/information_society/administrations/ps_034_en.pdf, Accessed March 5, 2008
3. Metaxiotis, K., Ergazakis, K. and Psarras, J: Exploring the World of Knowledge Management: Agreements and Disagreements in the Research Community, Journal of Knowledge Management, Vol. 9 No.2, p. 6-18, 2005
4. Wiig, K.: Knowledge management in public administration”, Journal of Knowledge Management, Vol. 6 No.3, pp. 224-239, 2002
5. Fraser J, Adams N, Macintosh A, McKay-Hubbard A, Lobo TP, Pardo PF, Martinez RC, Vallecillo JS: “Knowledge management applied to e-government services: The use of an

- ontology”, Knowledge Management In Electronic Government Lecture Notes In Artificial Intelligence 2645: 116-126, Springer-Verlag, 2003
6. Wimmer, M.: Implementing a Knowledge Portal for e-Government Based on Semantic Modeling: The e-Government Intelligent Portal (eip.at), Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06) Track 4 p. 82b, 2006
 7. The Government R&D Ontology, <http://www.daml.org/projects/integration/projects-20010811>, 2005
 8. The Government type Ontology, <http://reliant.tekknowledge.com/DAML/Government.owl>, CIA World Fact Book, 2002-2006
 9. The DIP project eGovernment Ontology <http://dip.semanticweb.org/documents/D9-3-improved-eGovernment.pdf>, 2004
 10. OntoGov Project, <http://www.ontogov.com/>
 11. ESTRELLA Project, <http://www.estrellaproject.org>
 12. LEX-IS Project, <http://www.lex-is.eu>
 13. Bouras A., Gouvas P., Mentzas G.: ENIO: An Enterprise Application Integration Ontology, in Proceedings of 18th International Workshop on Database and Expert Systems Applications, 2007
 14. Vassilakis C., Lepouras G.: An Ontology for e-Government Public Services, Encyclopedia of E-Commerce, E-Government and Mobile Commerce, 2006
 15. Barone A., Di Pietro P.: Semantic of eGovernment Processes: a Formal Approach to Service Definition (Arianna), in Proceedings of eGovINTEROP 2006, Bordeaux (France)
 16. Office of e-Envoy UK. e-Services Development Framework Primer v1.0b. 2002, Available from: <http://www.govtalk.gov.uk/documents/eSDFprimerV1b.pdf>.
 17. Peristeras, V., Tarabanis, K.: Governance Enterprise Architecture (GEA): Domain Models for E-Governance, Proceedings of the ICEC'04, Sixth International Conference on Electronic Commerce
 18. Cabinet Office, 2007, UK GovTalk Schema Library, <http://www.govtalk.gov.uk/schemasstandards/schemalibrary.asp> [Accessed 5 February 2007]
 19. KIU, 2007, Danish e-Government Project, InfoStructureBase, <http://isb.oio.dk/info> [Accessed 25 September 2007]
 20. XML-Infopoint, <http://www.kbst.bund.de>
 21. Web Ontology Language (OWL), <http://www.w3.org/2004/OWL/>
 22. Protege Ontology Editor, <http://protege.stanford.edu/>
 23. RacerPro Reasoner, <http://www.racer-systems.com>
 24. UN/CEFACT Core Components Technical Specification, Part 8 of the ebXML Framework, Version 2.01 (November 2003) , [http://www.unece.org/cefact/ebxml/CCTS_V2-01_Final .pdf](http://www.unece.org/cefact/ebxml/CCTS_V2-01_Final.pdf)
 25. The Greek eGovernment Interoperability Framework, 2008, available online at <http://www.e-gif.gov.gr>
 26. Lampathaki F., Charalabidis Y., Sarantis D., Koussouris S., Askounis D.: “E-Government Services Composition Using Multi-faceted Metadata Classification Structures”, in Lecture Notes on Computer Science Volume 4656 pp. 116-126, Proceedings of the 6th International Conference, EGOV 2007, Regensburg Germany, September 2007
 27. Charalabidis, Y., Askounis D., (2008), “Interoperability Registries in eGovernment: Developing a Semantically Rich Repository for Electronic Services and Documents of the new Public Administration”, Hawaiian International Conference of System Sciences, HICCS-08, January 7-10, 2008, Hawaii
 28. Gartner Group, Preparation for Update European Interoperability Framework 2.0 - Final Report, 2007, <http://ec.europa.eu/idabc/servlets/Doc?id=29101>