

Gathering requirements for eGovernment in the large – Conceptual framework and exemplary application

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Abstract: An increasing level of cooperation between public administrations nowadays on national, regional and local level requires methods to develop interoperable eGovernment systems and leads to the necessity of an efficient requirements engineering process. In this paper, we propose a framework to systematically gather requirements for eGovernment in the large. The framework is designed to help requirements engineers to develop a suitable requirements engineering process. The methodology is motivated and explained on the basis of a European research project.

1 Introduction

The European Union keeps growing and member states become more cross-linked every day. Some reasons are that governments are requested to work together more frequently, more intensely and in a vast and ever evolving environment. The drivers of change are manifold: modernization, a huge gap between the burden of work and the available resources, new legal settings and strategic commitments, new ICT¹, keeping up with the change taking place in private business settings, higher expectations for improved quality of service, enhanced public value generation, etc. One could list a large number of aspects implying the need for a smooth cooperation among public administrations and cooperation with their stakeholders on the basis and by means of advanced ICT [ZKM07].

¹ Information and Communication Technologies

What could be considered a fact anyway, is the underdevelopment of public sector compared to business sector in terms of ICT adoption, not to mention the lack of interoperability (IOP) at all levels, which lead on one side to a different business perception of the IOP problem (and of the different types of lacks of IOP) and to different requirements for the IOP solutions available. Regarding the development and application of ICT solutions the main challenges are the requirements specification and the management of customer requirements [SS03]. In this respect, the first step for the application of any ICT solution to public administrations is to gain a clear understanding of what their problems or needs are and to capture their requirements.

The presented framework of this paper is aimed at analyzing the needs of public administrations in terms of eGovernment in the large by improving the process of discovering, documenting and managing requirements. In this context, three main action domains were defined: the problem space, the requirements space and the solution space.

The paper is structured as follows: Section 2 sets up the scope of IOP in eGovernment. First, a snapshot of IOP in eGovernment will be presented. Based on this, we will discuss the differences between eGovernment in the large and eGovernment in the small and present an IOP lifecycle to support eGovernment in the large. Sections 3 introduces the conceptual framework to discover, document and manage requirements for an eGovernment in the large taking into account the problem, requirement and solution space. Section 4 presents the results of the application of the framework within the R4eGov² research project. Finally, section 5 provides a summary and describes future work.

2 Scope of interoperability in eGovernment

Within this growing Information Society as mentioned in section 1, networked governments have become a crucial factor. A major challenge for Governments across Europe is to link up heterogeneous systems in a way that these can work together smoothly. The obstacles to overcome in the public sector are a vast amount of stand-alone solutions under local control, which need to work together to enable seamless government. Often, these legacy systems may not be changed and adapted. [We05]

As a consequence, other options have to be found to pave the way for a smooth cooperation and collaboration. To enable cooperation (either in terms of collaboration or coordination), two approaches can be identified: integration or interoperation. Klischewski and Scholl define integration as “*the forming of a (temporary or permanent) larger unit of government entities for the purpose of merging processes [and systems,] and/or sharing information*” [KS06]. Integration is seen as not achievable across organizations for several reasons [We05]:

- the majority of eGovernment systems will always be heterogeneous; and

² <http://www.r4egov.info>

- the configuration of systems and definition of processes will always remain under local responsibility, management and control.

Since new emerging technologies allow loose coupling of systems by exploring web services, service-oriented architectures (SOA), etc., huge monolithic systems integrating heterogeneous legacy systems are required no more. As a consequence, interoperation has become the primary focus of investigation. In a working document, the European Commission defined IOP as “*the means by which the inter-linking of systems, information and ways of working, whether within or between administrations, nationally or across Europe, or with the enterprise sector, occurs*” [EC03]. This definition covers a wide understanding, addressing all levels of IOP (organizational, semantic, and technical, as well as across public/private/civic sectors). The European Interoperability Framework (EIF) of IDABC aligns IOP with “*the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge*” [EC04].

Klischewski and Scholl characterize interoperating systems and applications via independency, heterogeneity, and control by different jurisdictions/ administrations or by external actors; yet also cooperation in a predefined and agreed-upon fashion [KS06]. Likewise, interoperation can only be reached by means of open standards [WLM06].

To exploit the potentials of modern ICT to reach the vision of systems „*working in a seamless and coherent way across the public sector*“ [CO04], proper mechanisms of cross-organizational IOP are required, which enable different governments, and software components and applications to smoothly communicate with each other and to work together in the given settings. The EIF and other literature stress that IOP needs to be addressed on different levels to enable communication and cooperation among systems and services [BR04] [Be06] [EC03] [Gu04] [EC04] [KS06] [St07] [TT04] [WLM06]:

- *technical interoperability*: Linking computer services and systems together so that the systems and applications are able to communicate with each others based on standardised interfaces and commonly used open standards for metadata, document and data formats (e.g. XML, UTF), communication protocols (e.g. SOAP, HTTP, IP), and technologies (Web Services, etc.).
- *semantic interoperability*: Establishing a unique meaning of exchanged data, information and procedures by adding semantics to the information objects, or by establishing glossaries, thesauri or even ontologies. Standards in the field of semantic interoperability are required to ensure the exchange of information without depending on interpretations of humans. Only if the involved parties interpret data and meta-information consistently in the same commonly agreed-upon unique understanding, the information can be processed automatically in a meaningful manner. Thereby, standardised data definitions (e.g. XML, RDF, OWL, etc.), process models and object description frameworks are being used.
- *organisational interoperability*: This level of IOP – the most complex one – is concerned with aligning business processes and information architectures with organisational goals. Furthermore, overall agreements are settled on organisational

and legal level to enable processes to co-operate beyond organisational and state borders.

All three levels of IOP deserve equal attention in order to make systems communicate with each other and to link up governmental systems and services beyond organisational and national borders. With the linkage of administrative processes and data a significant increase in efficiency and lower operational costs can be achieved. Sturm describes numerous potentials for IOP in eGovernment as e.g. faster processing in administration, improving quality and service, organizational improvements or reduction of costs [St07].

It also became clear, that IOP can only be reached step by step. As a consequence, the next phases of future IOP activities should investigate two perspectives of IOP: eGovernment in the large (longer-term strategy) and eGovernment in the small (implementations achievable in the next few years).

2.1 eGovernment in the large vs. eGovernment in the small

The overall aim of IOP is to provide tools and methodologies for enabling organizations to smoothly collaborate in different use-contexts thereby being supported with advanced ICT. Aiming at **IOP in the large** means to enable smooth collaboration horizontally (across organizations of the same level of government: e.g. municipality with municipality) and vertically (across organizations of different levels of government: e.g. local – national – European). Thereby, organizations are probably not any more fully mastering the coordination of the cross-organizational processes lined up across organizations. E.g. a European directive enables an authority to check the registry entry of a bidder from another member state. In IOP in the large, the authority contacts the portal of the home business register (or a European business register) to gather the registry script from the bidder. Full IOP is reached when the home business register's system can retrieve the company registry certificate from any other Member State's business registry without having to agree on a standard data format of the script and with clear understanding of the peculiarities of the legal forms of each Member State without needing to bilaterally negotiate the meaning of the form's characteristics. In this IOP in the large, the Member State's organization is not mastering any more all point-to-point interfaces with other Member State's business registers. Instead, one unique IOP format is agreed upon, which is used by all Member State's business registers and other public and private organizations. Such IOP in the large is not feasible in the next few years. However, it is a driving vision for long-term networked governments.

In this context, **IOP in the small** will investigate concepts, technologies and tools to pave the way for such visionary cross-organizational collaboration while preserving the ability – and testing the concept - for IOP in the large. IOP in the small is understood as the organizations aiming at collaborating across their organizations to agree upon common IOP means to enable cross-organizational process execution supported with ICT. In this way, the organizations are fully in control of when and how the organizations collaborate to execute a public service.

2.2 Towards an IOP lifecycle for eGovernment in the large

The following IOP lifecycle serves as an organizing mechanism for managing the development of IOP solutions. Further on, it provides a structure for analysing requirements in a more detail. The single phases of the IOP lifecycle have been derived from existing lifecycles (e.g. WfMC [Ho95], FEAF [CIO01], ArKoS [Ho05] or [MZL06]) according to their suitability to serve as a basis for an IOP lifecycle taking into account the needs of public administrations (e.g. by giving more importance to a data and document phase that is characteristic for eGovernment scenarios).

The IOP lifecycle will answer the question of how to achieve IOP between legacy applications as well as how to design novel applications to be interoperable. The lifecycle follows the goals to include a broad preparation phase (strategy) and a feedback providing phase (monitoring) as well as the development of elements found in each enterprise information system: data and processes. Taking into account the need to prepare IOP solution for use in SOA, it also included a phase for the development of services (interaction components). Thus, the proposed IOP lifecycle covers the following five phases:

- The *cross-organizational strategy* phase refers to the development of an overall strategy of how to achieve IOP. In comparison to detailed concepts for single areas of IOP, this part defines a coarse grained strategy for which concepts to apply to secure and safeguard IOP.
- The phase of developing *interaction components* identifies and adjusts the components being part of a cross-organizational process. In order to identify such components, organizational (e.g. interaction policies), functional (e.g. process chains, data exchange standards) as well as existing technical components (e.g. interaction protocols, web services, or modules of a legacy system) have to be taken into account.
- The phase of *cross-organizational business processes* provides methods to develop and adjust interacting processes. This phase refers in a first step to the modeling of existing or intended cross-organizational processes by using modeling languages like the Event-driven Process Chain (EPC). Based on this, the phase aims in a second step at the execution of the modeled processes.
- The phase of *cross-organizational data storage* concentrates on collaborative management of data and documents. This comprises methods to automate document flows, to implement document standards, to annotate data etc.
- The phase of *cross-organizational monitoring* provides methods to supervise, monitor and analyze the cross-organizational processes, components and data repositories in order to improve the effectiveness and efficiency of the collaboration.

Note, that steps 2, 3 and 4 describe the design and implementation of distinct interaction dimensions but could be executed in parallel. Thus, seeing from a time perspective, the sequence of the IOP lifecycle would be step 1, step [2,3,4] in parallel followed by step 5.

3 Framework for gathering requirements for eGovernment in the large

In this section, the methodology for the elaboration of the requirements is described. The conceptual framework has the challenge to bring together the wide spread perspective of the different sources which requirements arrive from. The methodology takes into account existing requirements engineering approaches both from literature (e.g. [HJD05], [SS03]) as well as research projects (e.g. [ATHENA³]). In this context, three main action domains have been identified: the problem space, the requirements space and the solution space. Figure 1 depicts the overall methodology for the requirements combination process and shows the different sources the requirements come from.

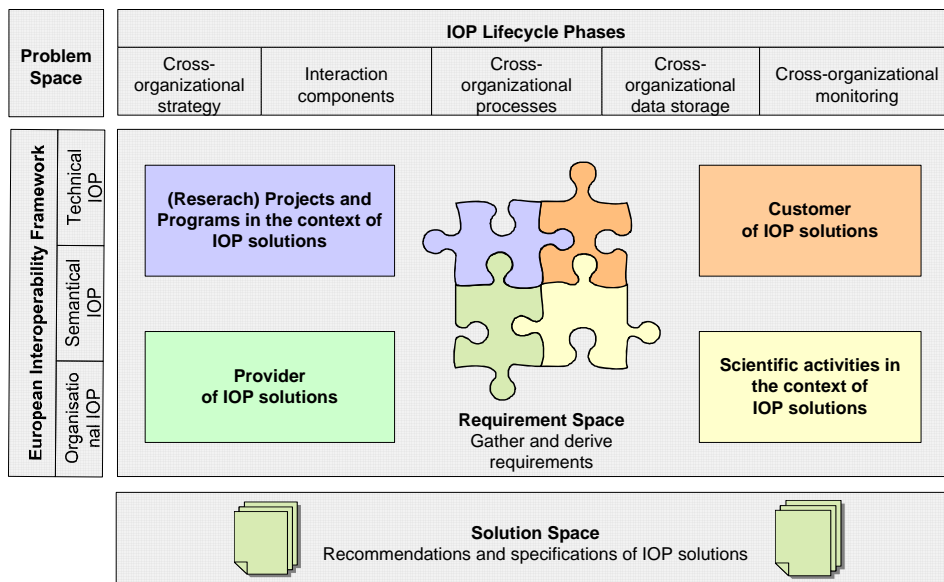


Figure 1: Conceptual Framework

The **Problem Space** addresses the particular needs of public administration to solve their current IOP problems. Different perspectives (organizational, semantical, technical), implementations achievable in the next few years to longer-term strategy as well as different phases to realize IOP solutions are comprised by the analysis of the problem space. The general question to be answered here is: how is the maturity of IOP solutions perceived in the context of eGovernment and what are the required perspectives to enable public administrations to adopt a specific IOP solution to solve their problems?

³ <http://www.athena-ip.org>

