

Designing Generic Municipal Services Process Models towards eGovernment Interoperability Infrastructures

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Abstract. Public Administration desks are in any country the most active point of transactions between the state governments and the citizens. This fact emphasises the importance of services offered by Public Administrations and in the modern technological era, it is essential for Information Technology to provide solutions for transforming these traditionally offered services into electronic transactions that could be initiated over the Internet, aiming at the facilitation of the citizen's life, who is the eventual "client" of any government. Although public administrations have strived over the last few years to meet this goal, their individual attempts resulted in isolated, ad-hoc systems, offering a small piece of the whole service bouquet. As the connectivity generated by the Internet is opening new opportunities in service delivery, public administrations are seeking ways to deliver integrated value-adding services though an Interoperable environment. The goal of a systematic service composition, which will guarantee eGovernment Interoperability, can be accomplished with an effective method of modelling the public services, in order to expose their interfaces and their actual workflow. Applying this method in Greek Municipalities by respecting the context of the emerging Greek eGovernment Interoperability Services Framework, various services have been analysed, leading to corresponding generic process patterns.

Keywords. eGovernment, Process Modelling, Interoperability, Public Administration Portals, Municipal Services

1. Introduction

The term of "eGovernment Interoperability" which is nowadays a keyword in the Information Technology agenda, focuses on the major issue of designing interoperable frameworks for system interconnection operating as commonly accepted and universal service platforms, whose end users will be the citizens and the enterprises [1] requesting services and demanding to be satisfied [2].

When referring to governmental service provision towards citizens and enterprises, Public Administrations possess the biggest piece of the pie and therefore are held responsible for huge amount of transactions between the state and the individuals. Entering the era of Information Technology, Public Administrations have realized that the provision of services in electronic formats will not only have a direct positive impact on the citizen's life, but will also relieve the organization itself from huge amounts of paperwork. Despite the rising pace at which Information Technology means are being deployed, the majority of several millions of daily transactions among the above entities are still carried out in the traditional manner and result in wasting significant effort and resources while not entrusting the Internet and service applications for their transactions [3]. This realization resulted in the implementation of Internet Services Portals for carrying out transactions with citizens and enterprises, covering mostly informative or basic transactions, that do not require high sophistication levels of back-office interconnection [4], [5].

As a result, up until now there is a great lack of Interoperability Patterns for achieving the seamless cooperation of heterogeneous, front-desk and back-office public administration systems and most important between different governmental agencies [6]. Services need to be interoperable in order to allow data and information to be exchanged and processed seamlessly across different government

eJETA Special Issue on "Interoperability for Enterprises and Administrations Worldwide"

Yannis Charalabidis, Hervé Panetto, Euripidis Loukis, Kai Mertins (eds), 2008

offices and organizations. In this framework, governmental organisations from all over the world are looking for technologies to facilitate the monitoring and interoperation of their processes in order to improve the service delivery to citizens.

According to the UN Report [7] “Services are the public face of government.”. EGovernment services effectively bring descriptions of lots of documents, services, people, systems, organizations and other resources together with the particular needs of an end-user and use that information to broker access to a subset of the network services available to that user in the government sphere. Despite this fact however, the monitoring of processes enactment and enforcement at the application level, which is logically expected, has not been adequately addressed [8]. Regarding Public Administration services knowledge and its expected spread over the different organizational levels for supporting the effective internal operation, one can easily find out that it is rarely provided in the desired transparent and structured form. Additional to this fact, employees do not seem possess the knowledge about the placement of their own tasks in an overall organizational process, as well as legal interdependencies and process and organizational relationships [9]. In terms of organizational design, a structured and transparent preparation of relevant information, about the processes’ steps and their interdependencies each government service includes, is another missing piece of the puzzle. In this context, the creation of a specified pool of process models describing public services and life events is seen as the remedy for increasing productivity and facilitating both the Public Administrations and the citizens. Through the use of such models, Public Administrations will be in a position to obtain a holistic description structure, thus production and management of government information are eased, while interoperability with other agencies is fostered [10].

This paper demonstrates the conceptualisation, design and implementation of a process modelling methodology which not only describes in adequate terms the operation of a municipality and visualise the process flows for each service, but also creates service patterns that expose the adequate information for implementing interoperable solutions on a national wide level between the different governmental organisations.

Chapter 2 of this paper describes briefly the current status of public administrations as it was recorder in Greece and tries to present the domestic and international policies and strategies which are aiming at the successful introduction of sophisticated eGovernment services in the public sector. Chapter 3 is presenting the overall methodology for building the Interoperable Generic Service Patterns and one model is revealed. Finally, Chapter 4 concludes.

2. Public Administrations in Greece; Their Status, Services and Visions

2.1 Present Situation

The Greek National Public Administration System is constituted of a large number of Local Administration Entities. In particular, there are more than 1.000 local administration organizations, mostly municipalities that provide governmental services to their citizens and visitors, as well as to enterprises that activate themselves inside the geographical limits of the municipalities. These services were until recently (and in the vast majority of the cases are still) provided in a conventional way, which means that no infrastructure has been developed yet, for providing electronic services and proves the poor level of ICT adoption in a local administration level. However, the situation seems to be

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changing over the last years, as many municipalities are developing their Municipal Web Portals, by implementing projects funded by the 6th Framework Program and the Greek Information Society, in order to achieve the goal of providing better services, creating ideal conditions for social activation of the citizens and improving the communication between the citizens and the Local and Public Administration.

Municipalities in Greece provide a very big number of services that appeal to citizens, visitors, businesses and other governmental bodies. The number varies from municipality to municipality because of the fact that the duties of each municipality are not always common, as they have their own institutional framework which depends on several parameters related to the distinctiveness of each one. Such parameters are the financial status of the Public Administration, the composition of the local population, cultural characteristics of the region, geopolitical and geographical parameters and other institutional and legal parameters that allow or not the municipality to offer some kinds of services.

In general, almost 200 services in average are provided by Greek municipalities. These services are split in general categories according to their nature and the person, entity or enterprise they refer to. Some indicative categories, as identified in [11] are: Payments, Applications, Registries, Records, Certificates and Licenses).

All the aforementioned services are provided, as stated above, in a conventional way that demands the presence of the person that applies for the service, in the municipality. That means that the interested person arrives in the municipality to hand in his application for a service, as well as to get the result of it. The poor level of ICT adoption by the municipalities is the main reason behind the aforementioned situation and does not allow “over the wire” provision of services to both citizens and enterprises.

2.2 Moving on to electronic service provision

The disengagement from the conventional way of servicing the public and the development of modern ICT infrastructures for providing electronic and interoperable services to citizens and enterprises is set as the main goal of Greek municipalities for the years to come. In this framework, municipalities have to develop functional web portals [12] or co-operate with alternative service providers [13] that will give the opportunity to citizens and businesses to complete on-line their transactions with the municipality in a fast, easy and secure way that does not demand their physical presence in the municipality. Governments should be able to fulfil the requirements of the various stakeholders, such as Public Administrations, IT Industry, Citizens and Enterprises, involved in the development of the appropriate infrastructures and the provision of electronic services, by taking into consideration the following viewpoints:

- a) The Enterprise Viewpoint which specifies aims, scope, processes and policies.
- b) The Information Viewpoint that describes the structure and semantics of the data to be processed, i.e. the data models.
- c) The Computational Viewpoint representing the breaking down of an eGovernment application / service into functional modules and their interaction interfaces.
- d) The Engineering Viewpoint which represents the distribution of the individual elements of an eGovernment system to physical resources and their connections.
- e) The Technology Viewpoint describing the technologies used to implement an eGovernment system.

The lack of infrastructures, however, is not the only barrier for providing electronic services [14]. Even if municipalities had developed the appropriate ICT infrastructures, their institutional and legal framework, as well as the complexity of the services’ processes, would allow them to offer only a small number of electronic services to citizens and businesses. For example, if we consider the 4-stage model

[15], for services, only 5% and 30% of the total number of services could be provided as level-4 and level-3 services, respectively. Taking into consideration all the aforementioned issues, the demand for radical changes in the institutional and legal framework that regulates the operation of Greek municipalities is a critical factor for the provision of electronic services at the highest level.

2.3 Initiatives, Programmes and Strategies

Over the last years, several actions have been launched, in order to give municipalities the opportunity to develop modern ICT infrastructures for providing electronic services to citizens, businesses, public entities and visitors. These actions refer to projects funded by the 5th and 6th Framework Program and the implementation of large projects such as the Greek eGovernment Interoperability Framework [16], the National One-Stop Governmental Portal (HERMES), the National Network of Public Administration (SYZEFXIS) the National e-Procurement System and the more than 1,000 Ministries, Prefectures and Municipalities Portals, constitute a major part of these actions and are often characterized as the highly visible manifestations of eGovernment progress in Greece.

The aforementioned actions aim at effectively supporting the provision of electronic services at Municipal Government and at contributing to achieving technical, semantic and organizational interoperability and meet the demands of the Greek Digital Strategy [Greek Information Society, 2005], contribute to the Lisbon economic and societal objectives [17] and harmonize with the pan-European policies and directions of i2010 [18]. The vision of this eGovernment service provision framework is to facilitate government in adapting to the digital era with the introduction of technical policies and specifications for achieving Information and Communication Technology (ICT) systems coherence across the public sector (G2G – Government-to-Government) and between the State and citizens (G2C – Government-to-Citizens) and the businesses (G2B – Government-to-Business).

Major European eGovernment policies and initiatives carried out, following the need for being aware of the eGovernment strategies with pan-European dimensions and specific country views are:

- The i2010 initiative, that determines general orientations of eGovernment policy, promotes the open and competitive digital economy and underlines the Information and Communication Technologies (ICT) as engines for social integration and quality of life.
- The eEurope initiative [19] that applies various actions that are simultaneously addressed over the two sides of equation: in the side of demand, actions for eGovernment, e-health, e-learning and e-commerce, are forecasted for the growth of new services. In the side of offer, actions that concern the broadband technology and the safety are expected to promote the spread of infrastructure.
- The eEurope Action Plan [20], which aims to the reinforcement of services, applications and content, referring both to electronic services and e-business and faces the amenable broadband infrastructure and safety issues.
- The IDABC Work Program [21], that aims to determine, support and promote the development of pan-European eGovernment services and relevant interoperable telematics networks, assisting the Member States and the European Community to apply their policies and actions, in order to acquire important benefits for the public administrations, the businesses and the citizens.

3. Process Modelling Methodology

3.1 Essential Modelling Technologies for eGovernment Interoperability

Nowadays, various Frameworks such as (UK e-GIF [22], German SAGA [23], European Interoperability Framework EIF [24]) are present, offering the guidelines that should be followed when designing systems and applications seeking interoperability with underlying and other external systems. Those frameworks define 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 of 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 information and overall business rules regarding local administration portals and services [25]. In this direction, the work presented in this paper comes as a methodology, which based on the ideas behind these frameworks, implements generic local administration service patterns for achieving interoperability, not only at municipal level, but also at a national-wide level, in order to align the services offered by each municipality to the needs that are set by the national eGovernment Interoperability frameworks (eGIFs).

Many international standards and state-of-the-art modelling languages and technologies should be used in an eGovernment architectures as they preserve their feasibility, accessibility, availability and security. The most important of those are the following:

- Unified Modelling Language [26], for modelling data components and forming widely accepted formatted documents.
- Business Process Execution Language [27], for modelling, orchestrating and implementing transaction flows using Web Services.
- eXtensible Markup Language (28), for modelling document data.
- XML Schema, for forming the XML Documents and introducing their generic formats
- The Core Component Technical Specification [29], for building up the data structures from baseline and elementary data components

Taking into consideration that in Greece and in other developing countries, where internet penetration and information technology's application is still in low figures, there is a lack of resources and technical expertise in public administration, which are relative small or medium governmental organizations [30], 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 [31].

3.2 Gathering Process relevant Data using Multi - facet Data Sheets

Electronic services are generally considered as the highly visible manifestations of eGovernment progress. However, in order for a municipality to design and deploy really functional and interoperable services, the need for the in-depth and detailed recording of service flows and service information emerges [32]. To this direction, the methodology proposed and applied for the service flow recording

uses respective questionnaires for service data extraction. The proposed methodology includes the following steps:

- 1) Arrange and carry out interviews with the municipality officers in order to record the services provided conventionally by the municipality.
- 2) Arrange and carry out interviews with the municipality officers and other proper municipality staff in order to record the service flows and service data for every service recorded in the previous step. The tool used for the recording of service flows and the extraction of service data, is the Questionnaire for Service Flow Recording and Service Data Extraction (see next section).
- 3) Fetch the documents involved in every service flow recorded in step 2. These documents include the application forms, the documents used for internal municipality documents, the documents traded between the municipality and other entities involved and the documents that represent the deliverables of the service.
- 4) Actualization of the recorded service flows in order to avoid mistakes and misunderstandings made during the interviews (Steps 1 and 2).
- 5) Modelling of the recorded service flows and development of the service flow models using an enterprise modelling toolkit.

In order to gather the necessary information to model the multitude of services provided by Municipalities, a Service Description Worksheet (SDW) has been constructed and contains all the service-related information, aiming at the description of the service “as-is”, without penetrating into “to-be” scenarios. There are 6 identified groups of facets for a service which are divided into sub-facets and have the purpose of describing specific characteristics of a service provided either electronically or conventionally in a methodological and coherent way that will facilitate the organization of the services into taxonomy. The objective of this taxonomy is twofold: to provide the means – based on its structure – for the systematic analysis of the contained services in order to deduct conclusions regarding, for example, the impact of the provided services and the required sophistication level, and to facilitate the service modelling with the help of an enterprise modelling tool. To this end, each facet identified describes in a straightforward way certain defining features of the service, specifically:

- **The General Information** facet represents the generic view of the service. It includes fields, such as a) the Service Code, b) the Service Title, c) the Providing Organisation, d) Involved Organisations, e) Final Service, indicating whether the service is final or the delivered result is required as an input for other services, f) Service Recipient, g) Service Nature in the sense that it recognizes the basic template type the service is classified to (e.g. licence/certificate/registration/request/objection/payment/return), h) Legal Framework, i) Self-appointed call of Service, that defines whether the service could be called only with the acquiescence of service receiver or a public organization may call it automatically, j) Information System support.
- **The Conventional way of Service Provision** facet provides additional requirements posed to the service when it is conventionally provided. It consists of the following fields: a) Requirement for Personal Presence at the submission of the application, b) Requirement for Personal Presence at the delivery of the service, c) Authentication Method.
- **The Electronic Service Availability** facet states the main characteristics of the electronic service, in particular: a) the Website URL, b) Means of service provision, c) Target Level of Sophistication representing the level of service provision according to the four stages that

have been adopted by the European Commission, d) Service Personalization e) Service Usability, which is set to levels according to the MIT Usability Guidelines [33], f) Multilingual Content, g) Online/Offline Service Operation indicating whether the service process can be accomplished fully online or the applicant can process it offline and then submit it, h) Potential for XML file dispatch, i) Service Progress Review referring to whether the applicant has the potential of reviewing the progress (status) of the service, j) Authentication Method, which identifies the requirements for user authentication and matches them to existing methodologies – e.g. basic authentication needs are covered through User ID/Password infrastructures, k) Security Need matching the required security level for the transmitted data to the underlying technologies used – e.g. advanced security level through HTTPS/SSL.

- **The Service Implementation** facet depicts the service’s workflow, including: a) the Required Documents List, b) the Service Steps followed for each involved organisation, c) the Delivered Documents List to the service recipient as proof of the service completion, d) Differences from service template model which describes the changes that exist in the flow of the service that differentiate it from the service template model (e.g. issuance of a birth certificate instead of issuance of a certificate), e) Clarifying Information about the service implementation.
- **The Service Importance** facet refers to the Service Frequency and the Service Importance according to European Policies like i2010.
- **The Service Tracing** facet identifies the Information Source and the Date of the Last Update.

A real world paradigm populating the proposed Multi-facet taxonomy has been drawn from the Services Descriptions Database and refers to the Greek Birth Certificate Issuance. The transaction is not automated at present and is provided with the conventional way taking place directly in the public administration offices.

General Information	
Service Code	G2C_024
Service Title	Birth Certificate Issuance
Providing Organisation	Municipality
Involved Organisations	-
Final Service	Yes
Service Recipient	Citizens
Service Nature	Certificate
Legal Framework	Municipalities Institutional and Legal Framework
Self-appointed call of Service	No
Information System support	Municipality Back-Office System
Conventional way of Service Provision	
Requirement for Personal Presence at the submission of the application	Yes, for submission at the municipality
Requirement for Personal Presence at the delivery of the	Yes, for submission at the municipality
Authentication Method	Demonstration of the (police) identification card
Electronic Service Availability	
Website URL	-
Means of service provision (i.e. Internet Browser, Mobile, Web Service, Telephone, ITV)	-

Target Level of Sophistication (i.e. Level 1 Information only, Level 2 One Way Interaction, Level 3 Two Way Interaction, Level 4 Full Case Handling)				-			
Service Personalization				-			
Service Usability (i.e awkward, bad, modest, good, handy, excellent)				-			
Multilingual Content				-			
Online/Offline Service Operation				-			
Potential for XML file dispatch				-			
Service Progress Review				-			
Authentication Method (e.g. None, Basic, Advanced)				-			
Security Level (e.g. None, Basic, Advanced)				-			
Service Implementation							
Required Documents List	Document Title	Document Code	Compulsory	Observations	Officially searched	Issuance Body/ Organisation	Issuance Organization's Information System
	Police identification card	G2C_109	Yes	-	-	Police	Police Information System
Service Steps	Service Viewpoint			Citizen			
	Service Beginning Event			Fill in the application form for the issuance of the birth certificate			
	Executed Process/Step	Next Process/Step	Transition from the executed process to the next process	Information System support	Required communication with external bodies	Existing Web Services for the communication	Supporting Documents List
	1.Fill in and submit the application form	2. Demonstrate the Police ID card	Directly				
	2. Demonstrate the Police ID card	3.Check the Police ID card and the application form	Directly	-	-	-	Police ID card
	3.Check the Police ID card and the application form	4. Issuance of the Birth Certificate	If the Police ID card is according to the application form data	-	-	-	Police ID Card
5. Reject the application form		If the Police ID card is not according to the application form data					

	4. Issuance of the Birth Certificate	6. End of Service	Directly	Municipality Back Office Information System	-	-	Police ID Card
	5. Reject the application form	Return to Step 1	Directly		-	-	
	6. End of Service				-	-	
	Service Completion Event			Issuance of Birth Certificate			
	Service Viewpoint			Municipality			
Delivered Documents List	Document Title			Document Code			
	Birth Certificate			G2C_110			
Clarifying Information							
Service Importance							
Service Frequency (e.g. High, Medium, Low)				50 applications in average per day			
Service Importance according to European Policies				Yes			
Service Tracing							
Information Source				Municipality			
Date of the Last Update				30/10/2007			

Table 1: Example SDW for Birth Certificate Issuance

3.3 Modelling views

Upon filling in the Service Description Worksheet, all relevant details regarding the service execution can be easily extracted and depicted in process diagrams with the help of enterprise modelling tools. Business Process Modelling Notation (BPMN) [34] is considered as the standard notation for services modelling in the proposed methodology, since it creates a standardized bridge for the gap between the business process design and process implementation and ensures that XML languages designed for the execution of business processes, such as BPEL (Business Process Execution Language), can be visualized with a business-oriented notation.

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

- The Public 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 modelling 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.

The Service Modelling Phase is designed to further distinguish between different description views that show particular points of view for understanding the service [35]. Description views [36] that have been identified within the proposed modelling methodology include:

- **Private Processes** that show all the activities, which are performed within the service. The focus is set on as-is organisational process modelling, which means that activities like internal decisions or internal administrative work are also included. Such activities usually provide rich information on business rules that impact the service design.
- **Public Processes** that show activities that are useful to understand the relevant service outputs and communication with an external entity. The significant process logic has to be indicated as well. Activities of the external entity are not described: the description scope ends with an indication about the exchanged document and message.
- **Collaboration Processes** that show a consolidation of public processes for two entities/roles. Public activities of each role are being linked through messages and interactions are then visualized very easily. This view is the basis for recognizing the interoperability points among different public organizations that need to be automated exploiting the Web Services technologies.

3.4 Services Homogenization & Generalisation

European Union has accepted a framework of a 4-stage classification model for the assessment of the progress of electronic services – transactions. The four levels, which are extensively explained in [37], [15], are the following:

- Level-1 Services: Information
- Level-2 Services: One-way Interaction
- Level-3 Services: Two-way Interaction
- Level-4 Services: Transaction

Besides this 4-level classification model, a new 5-level classification model is proposed [38] that separates the Level-4 Services Classification mentioned above into two new categories as stated below:

- Level-4 Services: Transaction which required users data insertion (by the user)
- Level-5 Services: Transaction with automatic fill in of the application form (Database uploading)

Due to the large number of services offered by each municipality and the tremendous amount of scattered data concerning them it is essential to define specific “Generic Models” or else “Generic Service Patterns” describing the actual service models in a higher and more abstractive view, aiming at the provision of the interfaces (in terms of service communication points and data entities), which, respecting the guidelines given by the national eGIF, will be in a position to guarantee and ensure the proper collaboration and synchronisation of those systems and services on a national level [39].

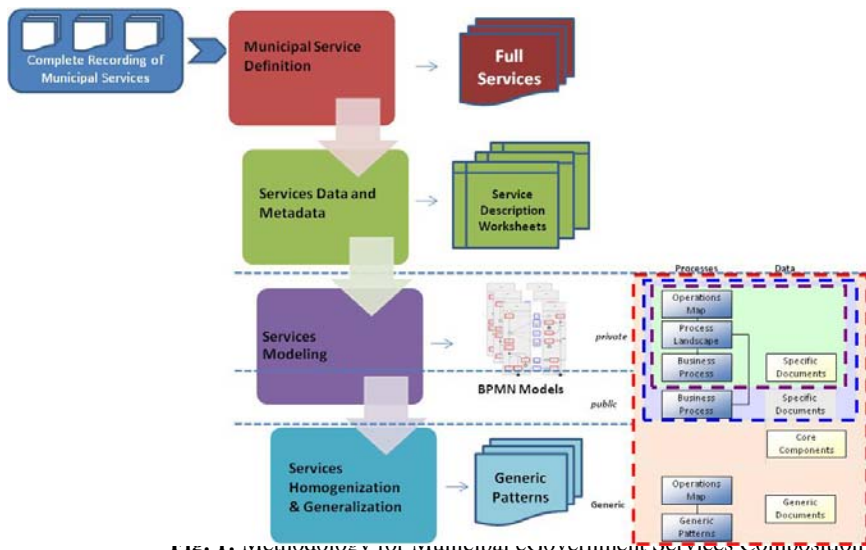


Fig. 1. Methodology for Municipal eGovernment Services Composition

In these terms, the homogenization and categorization of these services has led to these “Generic Services Patterns” which guide the implementation and evolution of the Complete List of Municipal Services towards an Interoperable Solution. With the help of the Service Description Worksheet, the necessary information for designing modelling diagrams is easily extracted, leading to a Collaboration Diagram, which reaches the level of analysis of a Private Diagram for each party involved to the service, and complies with the BPMN notation, as depicted in Figure 2. In particular, the methodology to reach the generic service pattern includes the following steps, as depicted in Figure 1.

With the methodology described above it became possible to group all the 200 services and extract from their models 6 discrete “Generic Service Patters, or else “Service Categories” which are Payments, Applications, Registries, Records, Certificates and Licenses. This categorization is the required step towards Interoperability as it groups together similar services and after careful examination of their workflows, generates and exposes universal interface points for data exchange and service calls between the different transaction parties. Moreover, as the whole methodology is respecting the guidelines that are proposed by the eGovernment Interoperability Framework, a public administration system that is based on this approach truncates into an open and discoverable platform capable of interacting with all similar developed platforms that respect the corresponding eGIF. Figure 2 presents the consolidated model, which can be called a “Generic Service Pattern” for a transactions belonging to the “Licence” category, that can be for example the issue of a licence of building a new house entrance.

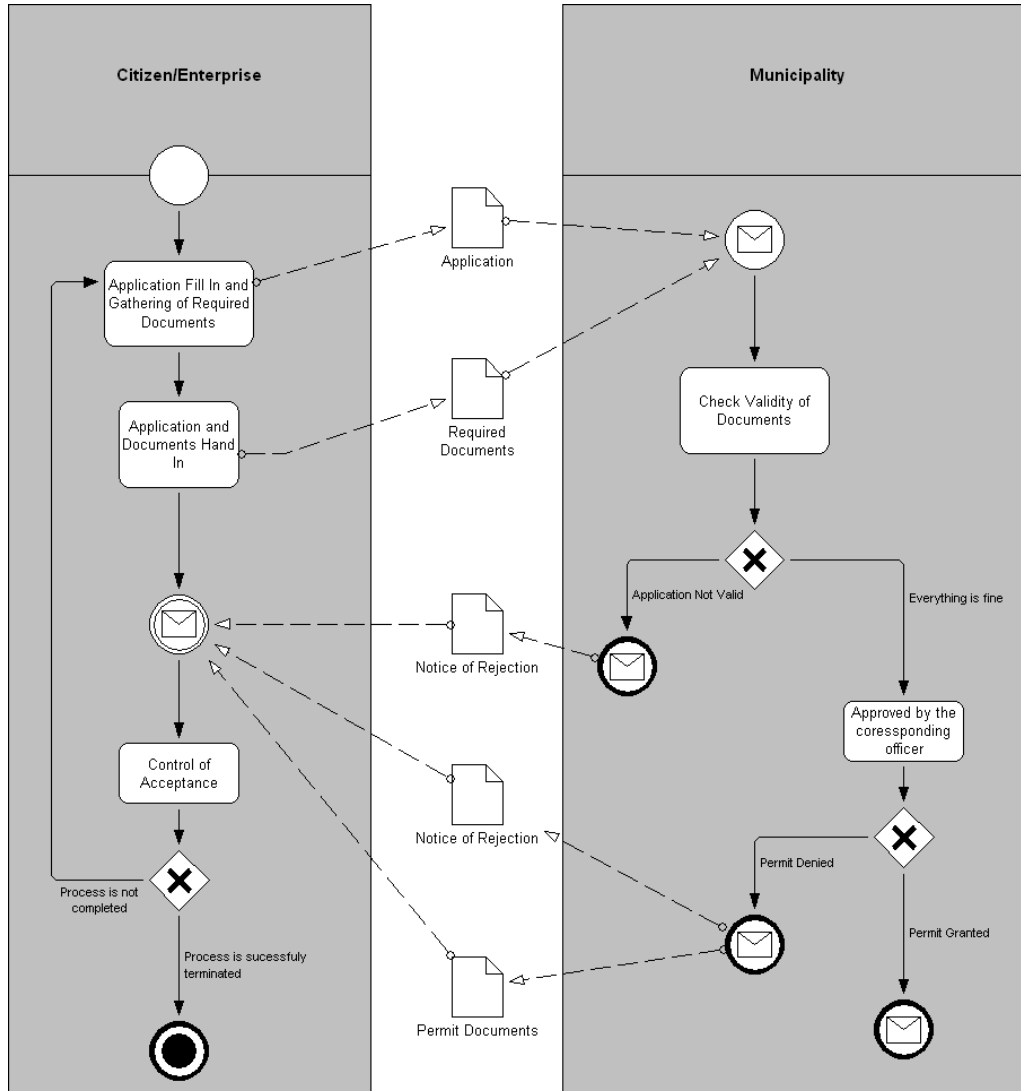


Fig. 2: Generic Service Patterns for “License” Category

4. Conclusions

The methodology described in this paper aims at supporting the Public Administrations to achieve resolution of organizational interoperability and to systematically address the Homogeneous Service Composition problem. By populating the Service Description Worksheets, extracting the gathered data facts and constructing the corresponding process models, the composition of service hierarchies and the design of interoperable Service Patterns are facilitated. Following such approach, it is possible to enable, amongst others:

- The homogenization and harmonization of the services leading to Service Patterns which can be customized to the needs and requirements of any Public Administration.
- The construction of interoperable service infrastructures, based on commonly accepted standards such as the eGovernment Interoperability Frameworks
- The comprehension of public governmental services under a single prism.
- The application of the BPMN Notation for modelling eGovernment Services
- The Facilitation of eGovernment service reengineering

All of the above mentioned targets are concluding into a single and unified Interoperable solution that can be used by every public administration for opening up its services to the wider public and for interacting with relevant organisations at higher automation levels.

Future steps along the proposed approach include formalization and generation of national level standardised documents, in order to achieve data interoperability and to put into comparison those standard XML document with corresponding documents from other EC countries in order to raise Interoperability to a pan-European level. Furthermore, this methodology is also being used in the modelling phase of the new emerging version of the Greek Interoperability Framework [39] and as a result, the methodology will be extended and tested against a bigger and more challenging domain than the one of Public Administration services. It is expected that the lessons learnt and further guidelines on how to design, deploy and modify patterns will derive from this attempt, which will aid at the completion and verification of this Process Modelling methodology for Interoperable eGovernment services.

Acknowledgement

Part of this work has been funded by the project PENED 2003. The project is cofinanced 75% of public expenditure through EC - European Social Fund, 25% of public expenditure through Ministry of Development - General Secretariat of Research and Technology and through private sector, under measure 8.3 of OPERATIONAL PROGRAMME "COMPETITIVENESS" in the 3rd Community Support Programme."

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