Modeling E-services in Public Sector

Egidijus Ostašius

Department of Fundamental Sciences, Vilnius Gediminas Technical University, Saulėtekio Ave. 11, LT-10223 Vilnius, Lithuania E-mail: EgidijusOstasius@gama.vtu.lt

Živilė Petravičiūtė

Department of Fundamental Sciences, Vilnius Gediminas Technical University, Saulėtekio Ave. 11, LT-10223 Vilnius, Lithuania, E-mail: Zivile.Petraviciute@vgtu.lt

Abstract. This article focuses on the modeling of e-services in the public sector. The approach is based on the reference model for service-oriented architecture (SOA). The modeling process is based on the idea of the Continuous Improvement Process. The common model is aimed to stimulate partnership among the public sector authorities involved in e-service constructing and delivery and should improve the efficiency and effectiveness of their activities, the quality of services by sharing knowledge, common services and information. It could be helpful to understand the specific issues in common problems that are related to the subject, to standardize the processes of e-services modeling and construction while seeking the optimal solutions for all parties. The proposed model was tested on the e-service of vehicle registration and could be used for building other public e-services in one-stop e-government. The proposed e-service model could be also used for evaluating the maturity and complexity of e-services systems and for comparison of particular e-services. The SOA architectural framework is proposed as a solution to reach the scalability, flexibility and reusability in building an e-service system.

Keywords: generic e-service model, one-stop e-government, service-oriented architecture (SOA), reference model for SOA, business process automation, business engineering, continuous improvement process, vehicle registration.

Introduction

The modern economy shifting from goods to services and the rapid expansion of the information economy and electronic networks are the two important trends that converge in the concept of e-service, i.e. provision of services through electronic networks. It stimulates public administrations, as well as any other organizations or individuals, to provide services using modern information and communication technologies. On the other hand, the growing customers' requirements of services stimulate e-services to respond more effectively to their needs. E-services should be easily and simply accessible in some standard way for a broad diversity of customers. Otherwise they could be not used because of complexity or unintelligibility. Initial evidence suggests that e-service delivery has a greater potential for success in the public sector tasks that have low or limited levels of complexity from the customers' point of view (Buckley, 2003). It means that e-services should be as simple and understandable as possible. The limited complexity of e-service does not mean just the level of complexity for the system itself that delivers e-service. E-service may

be regarded as a result of automating the business process of traditional service, but it is not the only feature that defines the phenomenon of e-service. Due to their increasing complexity, public services are typically not implemented by a single organization. Instead, they are composed of independent services hosted by different data and service providers. Usually, there are common problems white developing systems for such services, and there is little sense in making unique e-service projects separately; it is more reasonable to agree upon and cooperate for finding the common solutions applicable for all stakeholders.

An effective way to achieve this goal could be collaboration among the parties providing such services. However, such collaboration needs an agreement among the authorities, and the authorities must be interconnected. One form of the agreement could be the application and common understanding of a generic e-service model.

Services in public sector

We focus on modeling in the public sector e-services that are basically referenced from the Common List of basic public services (eEurope, 2001) (e.g., Personal Documents – Passports, eID, Driver Licenses, Car Registration, Application for Building Permission, Birth and Marriage Certificates, Announcement of Moving, Registration of a New Company, etc.), but the list is not restricted and may cover other public or commercial e-services as well. The services of interchanging data among the administrations are included here as well. For delivering all these services, Internet-based or non-Internet technologies and different access media

and devices including personal computers, mobile phones, electronic kiosks and other equipment could be used. To explain why we focus on the public services, we use three important features (eGov, 2001) that reveal differences if compared with the commercial domain. Electronic commerce commonly consists of buying and selling products and services through electronic systems and, like traditional commerce, is based on profit and competition as one of the main exceptional properties as compared with public services. However, in our context, there are more important exceptional items.

First of all, public administration and governance have been based on regulations – on laws and norms – over time. It means that laws and norms are a big knowledge stakeholder in public administration and governance, which is very helpful in the reengineering business process of the services and constructing and shaping e-services. The long-term work of the authorities has accumulated big assets of knowledge and experience. This knowledge, in the form of descriptions of business processes, is very helpful in the automation of realizing such services.

The second differing issue is that in many cases the nature of the services enforces collaboration among the parties involved in a given process of the services. Indeed, the specific characteristic of an administrator's work is not the logic but to interpret the regulations for an individual case to be performed. Frequently, automation is only feasible because in the design phase, a remodeling of norms, reengineering has taken place. Hence it follows that making the norms prone to automation is a way of legal interpretation

as well. It may be necessary to clear up the ambiguities of norms or to establish consistent interpretations persistent for a given administrative field. This means that common applicable interpretations are possible, and they could be accepted for all the parties involved in the process.

The third differing aspect lays in the great number of people involved in the administrative business. Therefore, numerous different data sources are involved in the processes of services. Persons influencing administrative processes come from governance, control, executive and legislative bodies. They also include citizens and private businesses. The number of different people involved in an administrative process may become much broader and more complex to determine beforehand, than the case of the private sector. Moreover, in comparison with the private sector, the amount of work that can be performed only in co-operation with other agencies is rather large and complex. The partnership here could be again a common approach and an interpretation of the administrative processes that could lead to the automation of work flow activities. The problem is that different administrations in the public sector have different experience and possibilities when developing their services and the systems that deliver these services. The result of such standalone activities of different authorities is the different maturity and quality of the services they provide. The way out of this situation could be stimulation of the consolidation of their efforts and sharing knowledge when modeling and constructing their e-services. It could also facilitate standardization of all the processes and would lead to the more efficient results.

As it is more convenient for the users to have a one-stop shop for services, it is reasonable to have some "central point", especially for public e-services. Usually, it is called one-stop e-government that refers to the integration of public services from a citizen's or company's point of view and allows a 24-hour access to the services from their home, their offices or even on the move. Online one-stop e-government requires that all public authorities are interconnected and that the customer (a citizen, a private enterprise or another public administration) is able to access public services through a single point, even if these services are provided by different administrative departments or authorities. It further requires that the customer is able to access these services in terms of 'life events', 'business events' or 'business situations' and that the customer does not need specific knowledge of the functional fragmentation of the public sector. 'Life events' describe the situations involving human beings that trigger public services. 'Business events' or 'business situations' describe topics involving the companies and self-employed citizens that trigger public services or interactions with public authorities. Employment, health, moving, starting new business, owning / driving a vehicle, marriage, birth and parenting, etc. are examples of 'life or business events'.

In most cases, there are possible frequent changes that will affect existing services and the systems providing these services for a variety of organizational, technical or procedural reasons. The number of different services will probably also grow when offering new possibilities and features for the users. People need better quality, more varied, simple to use, faster services, etc.

This implies a constant improvement of not only the services themselves, but also of the systems providing these e-services. This means that the e-service model should not be static, it should be flexible enough in the face of new circumstances and adapt to these changes easily and efficiently. On the other hand, it means that more sophisticated methods and techniques are needed for an integrated management and control of services and of such systems.

Solution for building one-stop e-government

Considerations of specific factors of public services together with the customer requirements and the need of stimulating the partnership among authorities show a necessity to build an 'adaptable common model' that could fit efficiently for practical applications in the public sector. In this case, an adaptive generic e-service model is proposed. The proposed model should be improved continuously by using the 'learning-by-doing' approach. This means that there is not a big chance to create *ad hoc* a 'unique recipe for all cases of life' for developing a one-stop e-government and constructing e-services, especially in the public sector. This paper presents one of the possible solutions for the model whose design is strictly oriented towards real life scenarios: the design of the model was based on practical experience acquired in the process of developing particular e-services and systems. It covers the initial version of the procedure that is part of behaviour of services for constructing the generic e-service model ('generic' here means common, an attempt to standardize the common issues that are related to most of e-services in the public sector;

the model is focused to fit the majority or all e-services in the public sector). The model covers most important aspects and actions of the e-services that are common in the public sector, such as person e-identification, data e-gathering and/or e-delivering, e-signing of e-documents, e-payments for services, and the real world effects – data transfer and change of the shared state (e.g., the status of the objects and/or subjects). The model covers three main types of interaction in the delivery of services: government to citizens (or government to customers) (G2C), government to business (G2B) and government to government (G2G). The procedure of the e-service model is defined as a sequence of elements that can be implemented mostly using Web services. But the model is not restricted to the Web services; in case of need, any other implementation strategy can be used.

The key to implementing one-stop shop infrastructure is the infrastructure behind it: to provide a secure customer self-service for back-end application, i.e. for managing the business processes. For this reason, it is necessary to employ the right tools, frameworks and methodology. One of the options how such services and systems can be developed, managed and controlled is to use the service-oriented architecture (SOA) and business process management (BPM) techniques.

Therefore, to implement heterogeneous services and systems, the integration technology must easily couple resources. Standards-based service-oriented architecture provides the technical possibility to create such systems. A great merit of the SOA is that it enables an agile, business-driven IT environment. A set of business, process, organizational, governance and technical methods provide a flexibility in treating the

business processes as well as the underlying IT infrastructure as the components that can be reused and recombined (Bieberstein, 2006).

Commonly, SOA projects embrace implementing solutions in very complex environments. For this reason, it is very important to employ the right methodology to help realize the value of SOA. An iterative business process management approach is used to deploy SOA solutions through the continuous end-to-end process lifecycle from analytical modeling, developing and deploying to performance management and optimization.

Therefore, SOA and BPM allow not only adding new elements to the procedure or changing the existing ones easily, but also modifying the sequence and logic of relationships among the elements that form the procedures of business processes of e-service.

The aim of the study was to build a generic e-service model for constructing e-services in the public sector. The objects of the research are e-services and their models. The methods employed are case studies, systematic, logic, conceptual and empirical analyses.

E-service model in a conceptual level

An approach to building a generic e-service model is based on the Reference Model (RM) for SOA (Oasis, 2006) as an abstract framework for understanding a significant relationship among the entities of some environment. The goal of the RM for SOA is to define the essence of service-oriented architecture, and emerge with a vocabulary and a common understanding of SOA. The main concepts this RM defines consist of main entities and relationships: service, service description, visibility, interaction, execution context, contract and policy, and the real world effect (Figure 1).

A **service** is a mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistently with constraints and policies as specified by the
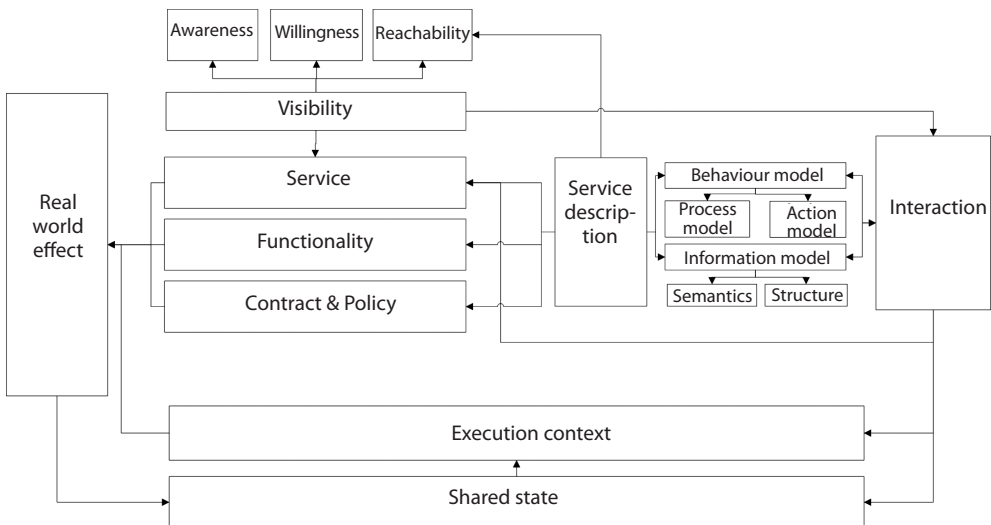

Figure 1. **Reference model of service-oriented architecture: entity relations**

service description. The consequence of invoking a service is a realization of one or more **real world effects.** These effects may include: 1) information obtained in response to a request for that information, 2) a change to the shared state of defined entities, or some combination of 1) and 2). The real world effect means that there is always a reason associated with providing a service, and the service consumer is trying to achieve some result by using the service. The goal can often be expressed as "trying to get the service to do something". This is sometimes known as the real world effect of using a service. For example, in case of vehicle registration, e-service can be used to change the owner of the car, i.e. the desired real world effect is a registered change of the owner of a vehicle. Thus, the real world effect may cause a change of some **shared state.** Shared state is a set of facts shared by the parties. The internal actions that service providers and consumers perform as a result of participation in service interactions may be private and fundamentally unknowable to each other. Actions by service providers and consumers lead to modifications of this shared, state and the real world effect of a service interaction is the accumulation of changes in the shared state. In case of our example, the register of vehicles provides a service of information about registered vehicles and, although external parties cannot see the private actions of vehicle registration service processes, they can access the shared information about the changed status and data of the vehicles. All these processes are executed in a certain **execution context** which means a set of technical and business elements – the infrastructure – that form a path between those with needs and those with capabilities.

In case of our example, there are policy assertions, regulations and agreements that define the options of vehicle registration and the offer for the customers on the one hand, and technical environments that support business processes of the service on the other. The service and the shared state and execution context depend on the **interaction** which involves performing actions against the service. In the e-service case, there may be several options for interaction:

1. **Human-to-system interaction**: this is accomplished by requesting and responding to the information that may affect the change of information, request for a service or the modification of the shared resources in an interactive way. In case of our example, it may be a request for a particular operation of the registration service or providing required personal data on a service consumer if there are no means to provide information for the service provider.

2. **System-to-system interaction**: this is accomplished by sending and receiving messages in an automatic way to receive information for the service that is not available for the service provider from another service provider who has this information. In case of our example, such information may be requested and provided by the Citizen Register and/or other register.

3. **System-to-human interaction**: this is accomplished by requesting for human interaction and/or human activities that cannot be automated meanwhile. In case of our example,

the vehicle registration license printing and delivery is a purely manual work.

Interaction is based on **visibility** which means that the service provider and the consumer, in order to interact, must be able to 'see each other'. Visibility is based on three entities:

1. **Awareness:** both the service provider and the service consumer must have information that would lead them to know of the other's existence. It is also required that the e-service description and policy be available in such a manner and form that, directly or indirectly, a potential consumer is aware of the existence and capabilities of the service. In case of our example, the service provider may advertise his service on his website and/or on the website of the e-government. It is beneficial if the service provider offers an online demo for e-service as an informative resource for the provider's service.

2. **Willingness** it is an intention to initiate and to participate in a service interaction. In case of our example, service consumer initiates service interaction with the service provider according to the 'life events' – his/her need of registration services, and the service provideris obliged by law to provide such a service.

3. **Reachability** means that service participants must be able to communicate with each other. If there is no communication between the consumer and the provider, the service is not visible to the consumer, and he/she cannot use it.

Service is defined by the **service description** that represents the information needed in order to use a service. The purpose of the description is to facilitate interaction and visibility, particularly when the participants are in different ownership domains, between participants in service interactions. Descriptions allow potential participants to construct the systems that use services and even offer compatible services. In particular, a service consumer needs to possess the following items of information:

1. That the service exists and is reachable. **Service reachability** is an inherently pairwise relationship between service providers and service consumers. However, a service description should include sufficient data to enable an interaction between the service consumer and the service provider to interact.

2. That the service performs a certain function or a set of functions. **Service functionality** description should unambiguously express the function(s) of the service and the real world effects that result from it being invoked. In case of our example, service functionality means the list of operations that concern the vehicle registration service, which can be selected by the service consumer, and the related information defining these operations.

3. That the service operates under a specified set of constraints and policies. **Service policy** conceptually means three aspects: policy assertion, policy owner and policy enforcement. Policy assertion

is often about the way the service is realized. In case of our example, policy assertion states that all applications on vehicle registration have to be signed by the owner of the vehicle or a person who has such a warrant of the attorney.

4. That the service will (to some implicit or explicit extent) complies with policies as prescribed by the service consumer. In case of our example, the security of personal data will be guaranteed by the service provider. There also may be needed a **service contract** which defines the terms and conditions of the service. In case of our example, the service contract means an application signed by the service consumer, where he/she applies for the particular registration operations.

5. How to interact with the service in order to achieve the required objectives, including the format and content of information exchanged between the service and the consumer and the sequences of information exchange that may be expected.

There are two basic models – the behaviour model and the information model – that define service business processing and interacting with a service that involves performing actions against the service. The **behavior model** involves the knowledge of the actions invoked against the service and the process or temporal aspects of interacting with the service. In case of our example, a comprehensive description of the services should be prepared to be able to automate the business process of the service. The behaviour model is composed

of the action model and the process model. **The action model** of a service is the characterization of the activities that may be invoked against the service. Activities can be divided into subactivities. The subactivities that cannot be further divided are called *actions* (atomic activities). Action is a named element which is the fundamental unit of executable functionality. An action forms an atomic execution and therefore completes without interruption. In contrast, an activity is a more complex collection of behaviour – subactivities and/or actions – that may run for a long duration. An activity may be interrupted by events, in which case it does not run to completion. In case of our example, identification of the person requesting the service, selection of the vehicle, request for vehicle information, checking for restrictions, selection of the license number plate, printing of a vehicle registration certificate are only some activity samples in the service process. The **process model** characterizes the temporal relationships and temporal properties of actions and events associated with interacting with the service. A process is defined as a set of linked activities that take an input and transform it to create an output (Johansson, 1993) or outputs. In many cases, the business process modeling technique in service process modeling may be applied. Different operations of the services may be represented by different process models – process definitions (scenarios). The **information model** involves the characterization of the information that may be exchanged with the service and/ or the information that the service provider possesses. The scope of the information model includes the format of information, the structural relationships within the

exchanged or stored information, and also the definition of the terms used. **Structure** means structural relations, the form and type of data elements required in interactions with a service. There may be several levels of such structural information, including the encoding of character data, the format of the data and the structural data types associated with elements of the information. **Semantics** means interpretation of the data that must be consistent between the participants in the service interaction. The primary task of any communication infrastructure is to facilitate the exchange of information and the exchange of intent. In case of our example, vehicle registration request combines two aspects: the fact that a consumer of the service intends to initiate the vehicle registration operation and the data that are related to the operation and other requirements of the service.

E-service model: behavioural part

We focus on the behaviour part of the RM for SOA (Figure 1) in this paper in more detail. The modeling approach is based on the Continuous Improvement Process (CIP) idea that means the ongoing efforts to improve the processes that compose the services we are focused on. These efforts can seek an "incremental" improvement over time or a "breakthrough" improvement all at once. Delivery (customer valued) processes are constantly evaluated and improved in the light of their efficiency, effectiveness and flexibility (ASQ).

Simulated service is a business process drawn upon a collection of related, structured activities (or processes) that depend on the specific features of the service and on a particular customer(s). In our model, one or more activities of the

procedure may be skipped. It depends on the type of the service provided. The model is illustrated by sample elements from the vehicle registration service procedure (Petraviciute, Kulvietis, Ostasius, 2006), and it was checked by implementing the model in the pilot system of a particular vehicle registration e-service. The initial procedure of the CIP for the construction of an e-service model is presented using the relations of activities that can be presented as a logical step-by-step sequence in the business process model (Figure 2):

1. E-service may be initiated by the human – the system user – or by the system itself and may be based on the 'life-events', 'business-events', 'business situations' or a request for information. Some samples illustrate 'life events' – birth, marriage, moving, buying a new car (initiated by human), expired passport, Id-card, driver license, vehicle registration (initiated by human or machine service).

2. Selection of the type of service means the choice of a particular service from the available list of public services (e.g., the list of 20 public services selected by the EU (eEurope, 2001)). One type of services could cover data access services from registers and information systems that can be used in any type of interaction.

3. User identification starts from authentication activities where the identity of the person accessing data or services is established. This involves verifying and confirming personal data provided by the user. The next step is authorization – the activity that allows access to the

data or services that are conditioned by the individual's access level and his/her role. It also determines the rights, privileges and obligations of the identified person, which depend on the accessing data or service. The user who will use the data or services offered can assume one or a combination of the following roles:

- *individual* – a person that can access data or services on his/her own behalf;
- *agent* – an individual or organization that can access data or services on behalf of another individual(s) or organization(s), provided that consent is granted to the agent by the data or service subject;
- *organizational representative* – an individual who can access data or services on behalf of an organization, provided that consent is granted to the data or service subject.

In case the service was initiated by the machine (e.g., G2G requests for information from a system of another authority), the user is identified and granted an access to the service or data as a machine according to the bilateral or multilateral agreement between the authority that provides service or data and the authority that requests the service or data. Here, also particular identification data must be used for the authentication and authorization of the machine or the service.

There could be options in this step, which depend on the type of the service when multiple users are involved in the e-service process:

4. Selecting the subject(s) of the service is optional (subject(s) in our context means individual(s) or organization(s)). It means the choice of a particular person or organization for whom the service should be provided or who is directly related to the service (e.g., a co-owner of the vehicle). It is also applicable when the subject(s) of the service is not the user but other person(s) and may be needed in cases when the service is executed by an organization representative (e.g., by the staff of the authority that provides the service) or by the agent that is authorized by the service initiator (e.g., by the owner of the vehicle).

5. Selecting the object(s) of the service means the choice of the particular object(s) from the list of objects available for a particular customer and for the type of service that was selected (e.g., a particular vehicle). The agent or the organization representative may represent many customers but access the objects of a particular customer only when they deliver the service to him or her.

6. Selecting the operation(s) for the service means the choice of a particular operation from the list of operations available for the selected object, the service initiator and for the type of service selected (the operation here means the subdivision of a particular type of service; the type of service may consist of one or more operations; operations cannot be subdivided). There should be a possibility to select one or more operations that
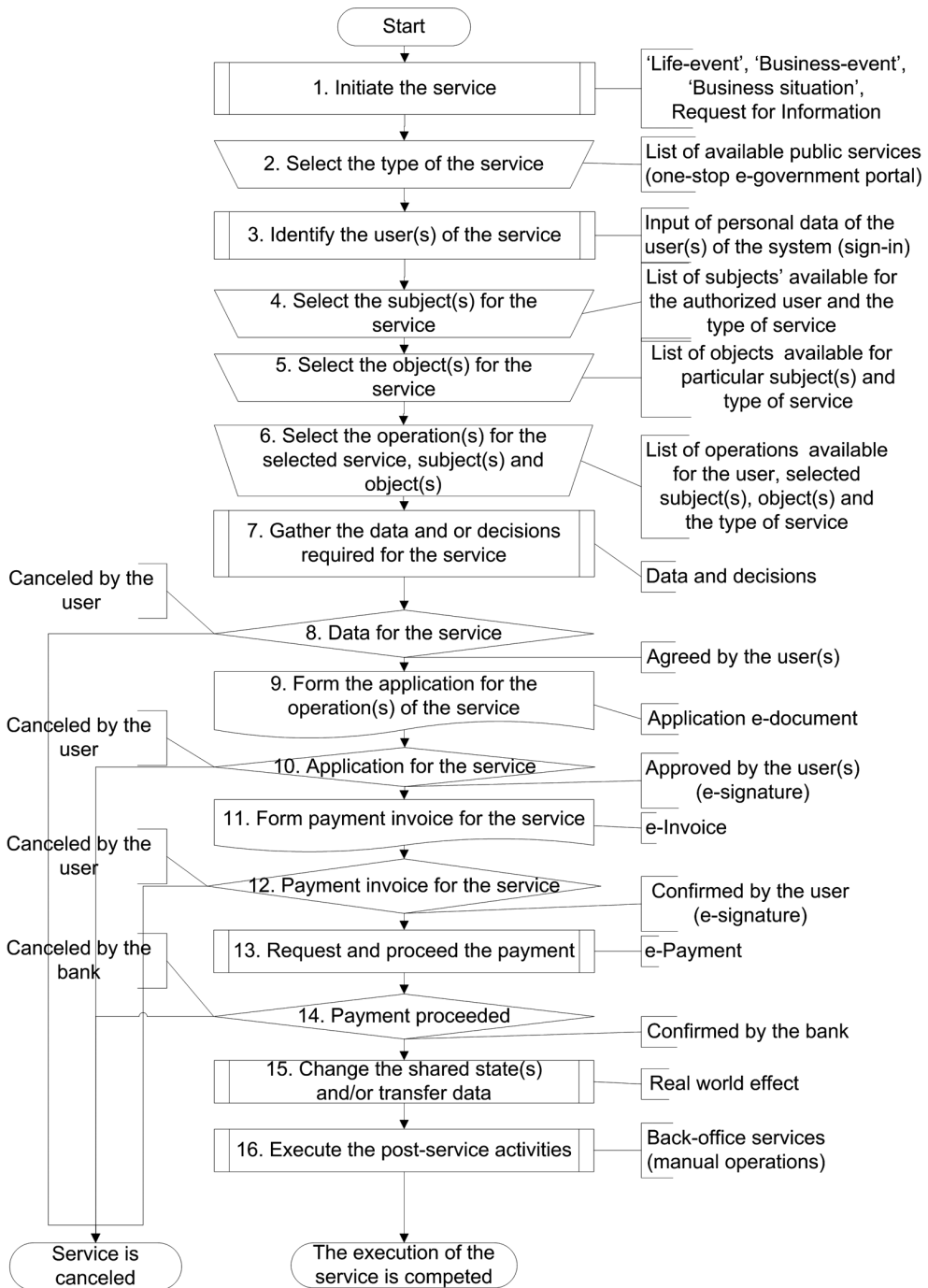
Start

1. Initiate the service — 'Life-event', 'Business-event', 'Business situation', Request for Information

2. Select the type of the service — List of available public services (one-stop e-government portal)

3. Identify the user(s) of the service — Input of personal data of the user(s) of the system (sign-in)

4. Select the subject(s) for the service — List of subjects' available for the authorized user and the type of service

5. Select the object(s) for the service — List of objects available for particular subject(s) and type of service

6. Select the operation(s) for the selected service, subject(s) and object(s) — List of operations available for the user, selected subject(s), object(s) and the type of service

7. Gather the data and or decisions required for the service — Data and decisions

Canceled by the user

8. Data for the service — Agreed by the user(s)

9. Form the application for the operation(s) of the service — Application e-document

Canceled by the user

10. Application for the service — Approved by the user(s) (e-signature)

11. Form payment invoice for the service — e-Invoice

Canceled by the user

12. Payment invoice for the service — Confirmed by the user (e-signature)

13. Request and proceed the payment — e-Payment

Canceled by the bank

14. Payment proceeded — Confirmed by the bank

15. Change the shared state(s) and/or transfer data — Real world effect

16. Execute the post-service activities — Back-office services (manual operations)

Service is canceled

The execution of the service is competed

Figure 2. **E-service procedure in public sector**

can be logically executed together for a particular service (e.g., change of the owner's address and the vehicle plate number).

7. Gathering data means that all the data and information that are required for the service and are electronically accessed should be gathered in an automatic way. The other required data and information that cannot be accessed electronically or are not available should be entered manually. Depending on the specific data, it could be done in two ways: entered by the customer himself/herself (e.g., selection of the address for the deliverables of the service – vehicle number plates and registration license; input of the phone number, e-mail address for communication) or by an agent or the organizational representative according to the contents of the data sources – non-electronic or electronic documents provided by the customer or organization. In this case, the agent or the organizational representative has to approve electronically the reliability of the entered data based on the original documents that were presented.

8. Optionally, all the gathered data are to be presented for checking to the user(s) who is working with the system, and he/she should confirm them or refuse in case of wrong or unsatisfactory data.

9. If the data are confirmed, an electronic application for the service should be formed (application in our context means some kind of contract between the service consumer and the service provider). It is optional depending on the type of the service and is drawn up according to the selections and data gathered.

10. This document should be presented to the user(s) working with the system, and he/she should approve or refuse it if he/she changes his/her mind or for other reasons (e.g., the price for the service is too high).

11. If the application is approved and the specific character of the service requires, an electronic invoice of the payment for the service is to be drawn up. The e-invoice is to be formed in an automatic way according to the specific details of the service and the pricelist of the services provided by the organization.

12. The e-invoice should be presented to the user(s) working with the system, and he/she should confirm or refuse it in case of any reason. Confirmation means that the user agrees to pay the specified sum for the service.

13. If the e-invoice is approved, the system sends the request to perform the e-payment transaction to the bank or other financial intermediary specified by the user, or perform other activities that are related with e-payment.

14. When an e-payment is executed, it could be confirmed or cancelled by the bank or other financial intermediary that performs e-payments.

15. After the financial intermediary has confirmed the e-payment, the execution of the service has to be started. The automatic part of the execution may cover only two functions: the change of the status

of the selected object(s) and/or subject(s), and/or data transfer(s) (e.g., change of vehicle registration status; transfer of data on a new owner to the vehicle register). Instructions for the manual execution of the service activities that cannot be executed in an automatic way should be compiled (e.g., an instruction to print the vehicle registration certificate and to deliver it to the customer).

16. If the instructions for the manual activities are compiled, they must be executed to finalize the service delivery.

The activities (or elements of the processes) in the presented procedure are arranged in a hard logical sequence because of certain empirical generalizations and taking into account the business process samples that were acquired in case studies and practical experience. However, there are possible exceptions that could be applied and examined separately (e.g., advance payment for the service).

According to the presented approach and the model for building the e-service systems, the key requirements for the design and development technique and tools should involve scalability, flexibility and reusability: it should be easy and simple to make changes that depend on particular changes in business processes and situations. Changes in such systems should be focused just on modifying, changing or adding components of the system without any intervention into its core or other elements. There should be a possibility to use the elements of common interest from the systems of different administrations. Also, an important feature is that the elements of the system should be based on the independent information technology platforms and common standards for interoperability of the elements. It should be easy to integrate the needed elements for such a system, even when the elements may be provided as independent services from the systems of different administrations or organizations. And, finally, there should be manageability: it should be simple to manage the integrated elements and the system itself.

Architectural framework for e-services development

In this paper, we focus on the SOA design technique based on services (Arsanjani, 2004: Jones, 2005). It is important to recognize that this paper does not encompass the mechanism used to deliver an individual service; rather, its purpose is to show how SOA can be used from the logical point of view.

An abstract view of SOA can be represented as a set of logical layers (Arsanjani, 2007) where a given layer does not entirely depend upon the layer below it. This architectural approach completely isolates and encapsulates the implementation details (technologies, infrastructure) and thus allows leveraging the advantages of the different technologies used for developing existing applications.

The architectural diagram shown in Figure 3 depicts SOA as a layered approach with operational systems as the lowest layer and the consumer layer as the highest. The middle layers comprise service components, services and business processes.

The consumer (or presentation) layer provides the possibility to deliver IT functions and data to consumers (humans

of administrations) to meet specific usage preferences. It provides the potential to create a front-end of business processes and composite applications through customer facing channels: portals, rich clients, mobile, portlet-based, web-based or other mechanisms and different access media devices including personal computers, mobile phones, electronic kiosks and other equipment.

Adopting proven front-end access patterns and open standards can decrease development and deployment cycle time through the use of prebuilt, proven, and reusable front-end building blocks. This practice provides a single incorporate view of knowledge presentation as well as a single unified entry point to the supported business processes and applications.

The business process layer plays the central coordinating role in connecting business-level requirements and IT-level solution components. The business processes are created due to the choreography and composition of the business services provided by service components. Services bundled into a flow through orchestration or choreography act together as a single application. These applications support specific use cases and business processes.

The services layer consists of all the services defined within the SOA. It covers atomic and composite services. As services are accessible independent of implementation, this capability allows a service to be exposed consistently across multiple customer-facing channels.

The services to provide the public services can be grouped into services of common interest (e.g., one-stop e-government portal, person e-identification, e-payment, e-signing of e-documents, drawing up e-documents) and specific services (e.g., process management, compiling a list of subjects / objects / operations, operation price formation, gathering of data according to process operations, e-document and e-payment data forming, printing of documents). The set of requirements and services contained by this layer can be used for a better leverage of the various capabilities provided by different vendors.

The service components layer provides the definition of a service, both in its functionality and quality of service. It consists of software components which provide the implementation and realization of or operation on a service. Service components may interact with operational systems to perform a business task.

The operational layer includes all existing application software systems running in an IT operating environment. This layer includes all monolithic custom applications, packaged applications and solutions, legacy applications and systems, data repositories.

In the SOA approach, the interface of a service is loosely coupled with its implementation, and the implementation is decoupled from its binding. Therefore, this architectural framework provides a flexible, decoupled functionality which can be reused. To sum up, implementing SOA can bring the following benefits (Arsanjani, 2007):

1. **Increased flexibility and re-usability**. Applications based on services are created in such a way as to facilitate a rapid restructuring and reconfiguration of the business processes and applications that consume them.

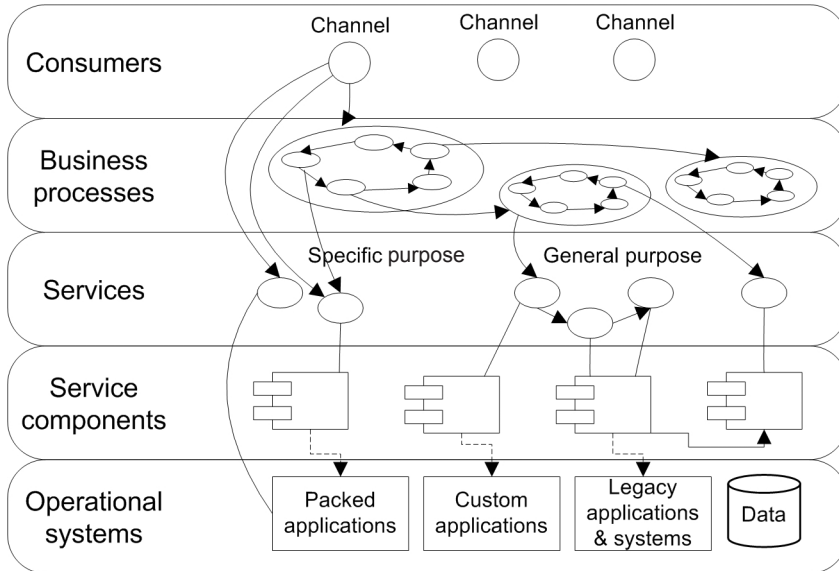2. **Added business agility**. Delivers

*Figure 3. **SOA layered model***

business-aligned applications faster. The one-stop shop infrastructure can be complemented with new electronic services while coupling a new service from existing services and adding specific ones.

3. **Increased consolidation**. Integrates IT systems across legacy, packed, custom and new applications and organizations.

4. **Alignment of business and IT**. SOA bridges the gap between business and IT.

5. **Reduced cost**. SOA provides a possibility to consolidate redundant application functionality and decouple functionality from obsolete and increasingly costly applications.

6. **Increased revenue**. Provides a possibility to enter new markets and to leverage existing business capabilities in new and innovative ways, using a set of loosely coupled IT services. Helps to increase market share by offering new and better business services.

Conclusions and prospects

An e-service model for modeling complex governmental processes is presented. The proposed e-service model can be used to model services in the public sector, promoting one-stop e-government solutions, to create system architecture for e-service development, to use as a tool for the benchmarking of services while comparing different or particular types of services. It can help the authorities to understand the ways of automation of business processes and facilitate the development of their e-services.

According to the model, the SOA solution is introduced for the development of e-services. The major capabilities afforded by SOA are the increase of flexibility, reusability and agility while designing and developing solutions that enable a continuous process improvement

and development circle. The proposed model with the application of SOA was validated on the design of a pilot system of e-services for vehicle registration.

Application of the generic e-service model on a national or/and international level could stimulate partnership among public administrations and promote development of collaborative networks (Camarinha-Matos, Afsarmanesh, 2005) in the public sector. The benefits of such a collaboration are likely to include a better quality of public services, higher efficiency and interoperability in the public sector, realization of the full potential of the concept of online one-stop e-government, development and promotion of a standard for providing public sector services.

The future works that are planned are focused on the further development of the model towards developing standards of the e-service model, checking the conformity of different e-services with the model, evaluation of the maturity and complexity of e-services, comparison of e-services of the same and/or different types.

REFERENCES

ARSANJANI, Ali (2004). Service oriented modeling and architecture [Online]. developerWorks. 2004. [Accessed 12 February 2010] Access through Internet: <http://www.ibm.com/developerworks/webservices/library/ws-soa-design1/>

ARSANJANI, Ali et al. (2007). Design an SOA solution using reference architecture [Online]. developerWorks. 2007. [Accessed 12 February 2010] Access through Internet: <https://www.ibm.com/developerworks/library/ar-archtemp/>

ASQ. Continuous Improvement. American Society for Quality. [Online] [Accessed 12 February 2010] Access through Internet: <http://www.asq.org/learn-about-quality/continuous-improvement/overview/overview.html>

BIEBERSTEIN, Norbert et al. (2006). Service Oriented Architecture (SOA) Compass: Business Value, Planning, and Enterprise Roadmap. IBM Press, 2006, 272 p. ISBN 978-0131870024.

BUCKLEY, Joan (2003). E-service quality and the public sector. *Managing Service Quality*, 2003, 13(6), p. 453–462.

CAMARINHA-MATOS, Luis M., AFSAR-MANESH, Hamideh (2005) Collaborative networks: a new scientific discipline. *Journal of Intelligent Manufacturing*, 2005, No. 16, p. 439–452. [Accessed 2 June 2010] Access through Internet: <http://www.uninova.pt/~cam/Papers/ColNetsJIM.pdf>

eEUROPE (2001). Common list of basic public services. 2001. [Online] [Accessed 12 February 2010] Access through Internet: <http://ec.europa.eu/idabc/servlets/Doc?id=18402>

eGOV (2001). An Integrated Platform for Realizing Online One-stop Government. eGOV Consortium, 2001.

JOHANSSON, Henry et al (1993). Business Process Reengineering: Breakpoint for Market Dominance. Wiley, 1993, 1st ed. 256 p. ISBN 978-0471938835

JONES, Steve; MORRIS, Mike (2005). A methodology for service architectures [Online]. Capgemini. 2005. [Accessed 12 February 2010] Access through Internet: <http://www.oasis-open.org/committees/download.php/15071/A%20methodology%20for%20Service%20Architectures%201%202%204%20-%20OASIS%20Contribution.pdf>

OASIS (2006). Reference Model for SOA. [Online] 2006 (1.0) [Accessed 12 February 2010] Access through Internet: <http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.pdf>

PETRAVICIUTE, Zivile; KULVIETIS, Genadijus; OSTASIUS, Egidijus (2006). SOA Approach for E-services. *WSEAS Transactions on Business and Economics*, 2006, No. 3(4), p. 594–596.

ELEKTRONINIŲ PASLAUGŲ MODELIAVIMAS VIEŠAJAME SEKTORIUJE

Egidijus Ostašius, Živilė Petravičiūtė

S a n t r a u k a

Straipsnyje nagrinėjamas elektroninių paslaugų modeliavimas viešajame sektoriuje. Pateikiamas elektroninės paslaugos modelis buvo sukurtas remiantis į paslaugas orientuotos architektūros abstrakčiuoju modeliu. Modeliavimo procesas yra grindžiamas nuolatinio proceso tobulinimo idėja. Bendrojo elektroninių paslaugų modelio tikslas – skatinti partnerystę, dalytis žiniomis ir turima informacija tarp viešojo sektoriaus valdžios institucijų, atsakingų už elektroninių paslaugų kūrimą ir teikimą, siekiančių pagerinti jų teikiamų paslaugų veiksmingumą ir kokybę. Modelis gali būti naudingas atskleidžiant bendras problemas, standartizuojant elektroninių paslaugų modeliavimo ir konstravimo procesus, visoms suinteresuotoms šalims ieškant optimalių sprendimų. Pateiktasis modelis buvo išbandytas kuriant transporto priemonių registravimo elektroninę paslaugą ir gali būti naudojamas kuriant ir kitas viešas elektronines paslaugas, kurios gali būti teikiamos „vieno langelio" elektroninės valdžios vartuose. Pasiūlytą modelį galima naudoti vertinant elektroninių paslaugų brandą ir jų bei jas realizuojančių sistemų sudėtingumą, taip pat lyginant tam tikras elektronines paslaugas tarpusavyje. Kaip technologinis sprendimas, kuriant tokių elektroninių paslaugų sistemas, yra pasiūlyta į paslaugas orientuota architektūra, kuria siekiama sukurti išplečiamas, lankščias ir daug kartų lengvai panaudojamas sistemas.