CONSTRUCTING A GENERIC E-SERVICE MODEL IN PUBLIC SECTOR

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Abstract. This article focuses on constructing a generic e-service model in public sector. An approach is based on Reference model for Service Oriented Architecture and Continuous Improvement Process. The proposed model was tested on the e-service of vehicle registration and could be used building public e-services in one-stop e-government. Another application of e-service model could be in evaluation of maturity and complexity of e-service and for comparison of particular e-services. The model could be helpful for the authorities to understand the specific issues in common problems that are related to e-service constructing and delivery, to standardize the processes of modeling and constructing of e-service that can improve the efficiency through partnership. The SOA architectural framework is proposed as a solution to reach the scalability, flexibility and reusability to build the e-service system.

Keywords: generic e-service model, continuous improvement process, business process automation, e-service, public services, one stop e-government, service oriented architecture, vehicle registration

1 Introduction

There are two most important long-term trends in the business world – shifting of the economy from goods to services and rapid expansion of the information economy and electronic networks. These two trends converge in the concept of e-service, which is provision of the service over electronic networks. Public administrations like any other organizations or individuals can provide electronic services using modern information and communication technologies. Initial evidence suggests that e-service delivery has greater potential for success in public sector tasks that have low or limited levels of complexity from the customer point of view [5]. It means that e-services should be as simple and understandable as possible. Limited complexity of the e-service does not mean straight the level of complexity for the system that deliver the e-service. We can define e-services as the result of automation, enhancement and integration of the business processes of the traditional services that are moving towards the e-services *on demand* [8]. Due to their increasing complexity public services are typically not implemented by a single organization that provides the service. Instead, they are composed of independent services hosted by different data and service providers. As usually there are common problems (e.g. e-Identification, e-Document, e-Authentication, e-Payment, etc.) developing systems for such services but there also common solutions may be possible and can be found for the problems that must be solved. And there is a little sense to make such unique e-service projects separately but to agree and to cooperate for the common solutions that are applicable for all stakeholders.

The growing users' requirements stimulate the provided e-services to respond more effectively to their needs. E-services should be easily and simply accessed in some standard way using Internet-based or non-Internet technologies and different access media and devices including personal computers, mobile phones, electronic kiosks and other equipments. An effective way to achieve it is through the partnership between the authorities providing such services what is often missing and the problems are to be solved separately, with little or no collaboration. But for the partnership there is a need of a common agreement between the authorities and that the authorities must be interconnected. One form of the agreement could be a common – generic e-service model for public services.

We are focused on modeling of electronic public services in this paper. They are basically referenced from the Common list of basic public services [6] (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 it is not restricted and may cover other public or commercial e-services as well. The services of interchange of data between administrations that are needed for the support of services that are provided by the administrations are included here as well.

Following [7] we mark out three important specifics of the public services that provoke differences if comparing them with commercial domain and partly explain why we're focused on the public services. Electronic commerce commonly consists of the buying and selling of products and services over electronic systems and as a traditional commerce is based on profit and competition what is one of the main exceptional properties comparing with public services. But in our context there are more important next exceptional items. First of all, public administration and governance have been structured and integrated in laws and norms over time. It means that laws and norms are somehow a big knowledge stakeholder in public administration and governance and it is very helpful in business process reengineering of the service and constructing and shaping

of e-services. A longterm work of the authorities has accumulated big assets of knowledge and experience. This knowledge in form of regulations and descriptions of business processes is very helpful in automation of realizing such services. The second differing issue is that in many case 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 law for the individual case to be performed. Frequently, automation is only feasible because in the design phase, a remodelling of norms, reengineering had 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 ambiguities of norms or to establish consistent interpretations, which are at least persistent for a given administrative field. That means that common applicable interpretations are possible and they could be accepted for all the parties involved in the processes. The third differing aspect lays in the many people involved in the administrative business. And according that – many different data sources are involved in the processes of the services. Persons influencing administrative processes come from governance, control, executive and legislative. They also include citizens and private businesses. The sum of different people involved in an administrative process may become much broader and more complex to determine beforehand, than it is the case in the private sector. Moreover, in comparison to the private sector, the amount of work that only can be performed in co-operation with other agencies is rather high and complex. The advantage of the partnership here could be again a common approach and interpretation of the administrative processes that could lead to the automation of work flow activities accordingly. The problem is that different administrations in public sector have different experience and possibilities when developing their services. The results are different maturity and quality of the activities of the services that usually are provided by different authorities. A generic e-service model could consolidate their efforts and to share their knowledge when modeling and constructing their e-services. It also could facilitate to standardize all the processes and would lead to the more efficient results.

As it is more convenient to the users to have one-stop shop for services it's worth to have some "central point" especially for the 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 to have 24-hours access to the services from their home, their offices or even on the move. Online one-stop government requires that all public authorities are interconnected and that the customer (citizen, private enterprise or other 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 situations involving human beings that trigger public services. "Business events" or "business situations" describe topics involving companies and self-employed citizens that trigger public services or interactions with public authorities. Some examples of 'life or business events' are: employment, health, moving, starting new business, owning/driving vehicle, marriage, birth and parenting, etc.

In most cases there will be constant changes that will affect existing services because of variety of organizational, technical or procedural reasons. And the number of different services will grow when offering new possibilities and features for the users. People need better quality of service, more variety, simple use, faster services, etc. what point out to the constant improvement of the systems providing e-services. It means that e-service model cannot be static and should be flexible enough with maturing possibilities and adapt these changes easily and efficiently. On the other hand that means that more sophisticated methods and technique are needed for the integrated management and control of the services and such a systems.

We propose an adaptive e-service model that continuously improves using a „learning-by-doing" approach. The dynamics of real life dictates that the model should be open and flexible enough to be able to accumulate new changes, new requirements, new experience that continuously arrive. It means that there is not a big chance to create ad hoc „an unique recipe for all cases of the life" for development of one-stop e-government and for the construction of e-services in public sector. This paper presents one of the possible options for a generic e-service model whose design was strictly oriented towards real life scenarios: the design of the model was based using practical experience that was acquired in the process of developing of particular e-services and systems. It covers the initial version of the procedure that is part of behavior of the services for the construction of the generic e-service model („generic" here means the commonality, a try to standardize the common issues that are related to most of the e-services in public sector, the „model" is focused to fit for the majority or all the e-services in public sector). The model covers most important aspects and actions of the e-services that are common in public sector like person e-identification, data e-gathering and/or e-delivering, e-signing of e-documents, e-payments for the services, and the real world effects – data transfer and change of the shared state (e.g. status of the objects). The model covers three main types of interaction of the delivery of the services including government to citizens (or government to customers) (G2C), government to business (G2B) and government to government (G2G). We define the procedure of the e-service model as a sequence of elements that mostly can be implemented using Web services. But the model is not restricted of the Web services and if it is needed there can be used any other implementation strategy for the element.

The key to implement one-stop shop infrastructure is about infrastructure behind it: to provide secure customer self service to back-end application, to manage business processes. For this reason, it is necessarily to employ the right tools, frameworks, and methodology. One of the options how can be developed, managed and controlled such services and systems is by using 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 ability to create such systems. The great value that SOA enables is an agile, business driven IT environment. The set of business, process, organizational, governance and technical methods provide the flexibility to treat the business processes as well as underlying IT infrastructure as components that can be reused and recombined [4].

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

Therefore, SOA and BPM allow not only add new elements to the procedure or change the existing easily but also to modify the sequence and logic of relationships between the elements that form the procedures of business processes of the e-service.

2 Modeling public e-services

An approach we use building a generic e-service model is based on the Reference Model (RM) for SOA [11] as an abstract framework for understanding significant relationships 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 principle concepts this RM defines consist of main entities and relationships: service, service description, visibility, interaction, execution context, contract & policy and real world effect (see the Figure 1 below).

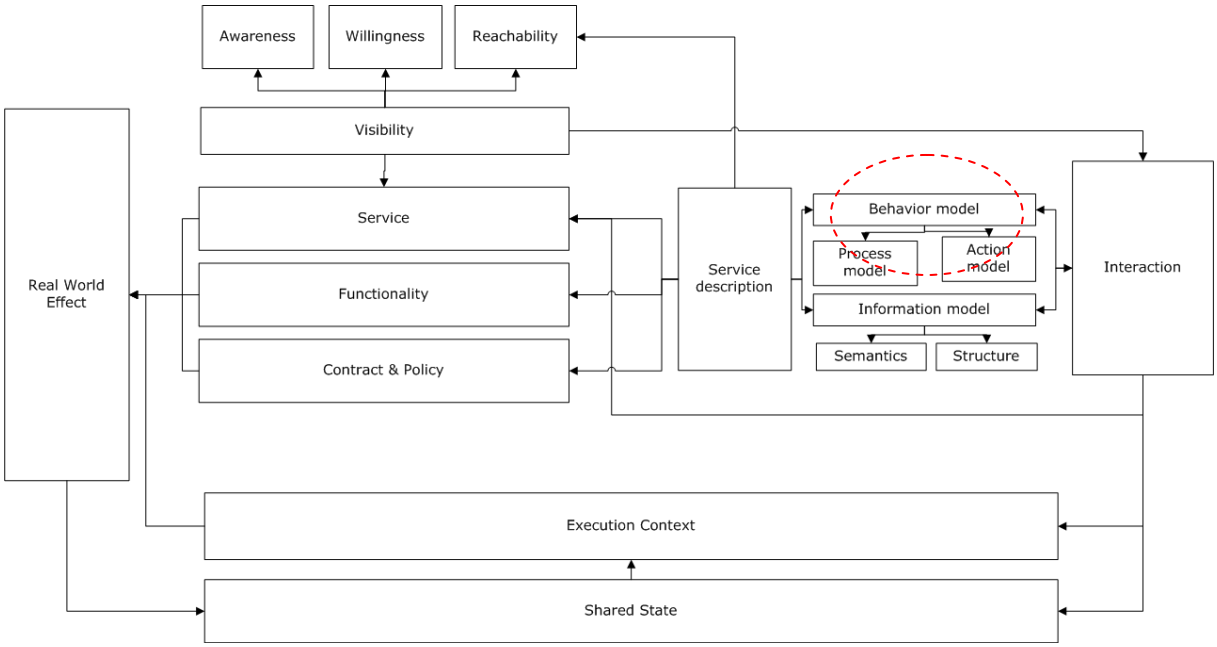

Figure 1. Reference model for service oriented architecture: entity relations

We focus on a **behavior model** part of the RM for SOA in this paper in more detail. 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 modeling a particular service a comprehensive description of the services should be prepared, to be able to automate the business process of the service. Behavior model is composed of action model and process model. **Action model** of a service is the characterization of the activities that may be invoked against the service. Activities can be divided into subactivities. Subactivities that cannot be further divided are called actions (atomic activities). Action is a named element that 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 behavior – 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 license number plate, printing of vehicle registration certificate they are only some activity samples in service process. **Process model** characterizes the temporal relationships and temporal properties of actions and events associated with interacting with the service. We use definition of a process as a set of linked activities that take an input and transform it to create an output [9] 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).

Modeling approach is based on Continuous Improvement Process (CIP) idea that means an ongoing efforts to improve processes that compose the services we‘re focused on. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once. Delivery (customer valued) processes are constantly evaluated and improved in the light of their efficiency, effectiveness and flexibility [3]

The service we‘re modeling is a business process that is drawn upon a collection of related, structured activities (or processes) that depend on the specific of the service and the particular customer(s). In our generic model one or more activities of the procedure may be skipped. It depends on the type of service provided. To illustrate the model we use the sample elements from the vehicle registration service procedure [12] and it was checked by implementing the model in the pilot system of the particular vehicle registration e-service. An initial procedure of the CIP for the construction of the e-service model is presented using the relations of activities' that can be presented in a shape of a logical step-by-step sequence in the business process model (Figure 2).

1. E-service may be initiated by the human – by the system user, or by the system itself and be based on the life-events, business-events, business situations or request for information. Some samples illustrate 'life events‘- birth, marriage, moving, bought 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 the service means the choice of the particular service from the available list of public services (e.g. the list of 20 public services selected by EU [6]). One type of the services could cover the data access services from registers and information systems that can be used in any type of interaction.
3. User identification starts from authentication activity where the identity of the person accessing data or services is executed. That involves verifying and confirming of personal data provided by the user. Next step is authorization – the activity that allows the 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 be using the data or services offered can assume one or a combination of the following roles:

   3.1.*individual* – a person that can access data or services on his/her own behalf;

   3.2.*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;

   3.3.*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 the system of other authority) the user is identified and granted to access the service or data as a machine according to the bilateral or multilateral agreement between the authority that provide service or data, and the authority that request the service or data. Here also must be used the particular identification data for the authentication and authorization of the machine or the service.

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

4. Selecting the subjects of the service is optional (subjects in our context means individual(s) or organization(s)). It means the choice of the particular person or organization for whom the service should be provided or who is directly related to the service (e.g. joint owner of the vehicle). It‘s also applicable when the subject of the service is not the user but other person(s) and may be needed in cases when the service is executed by the organizational 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).

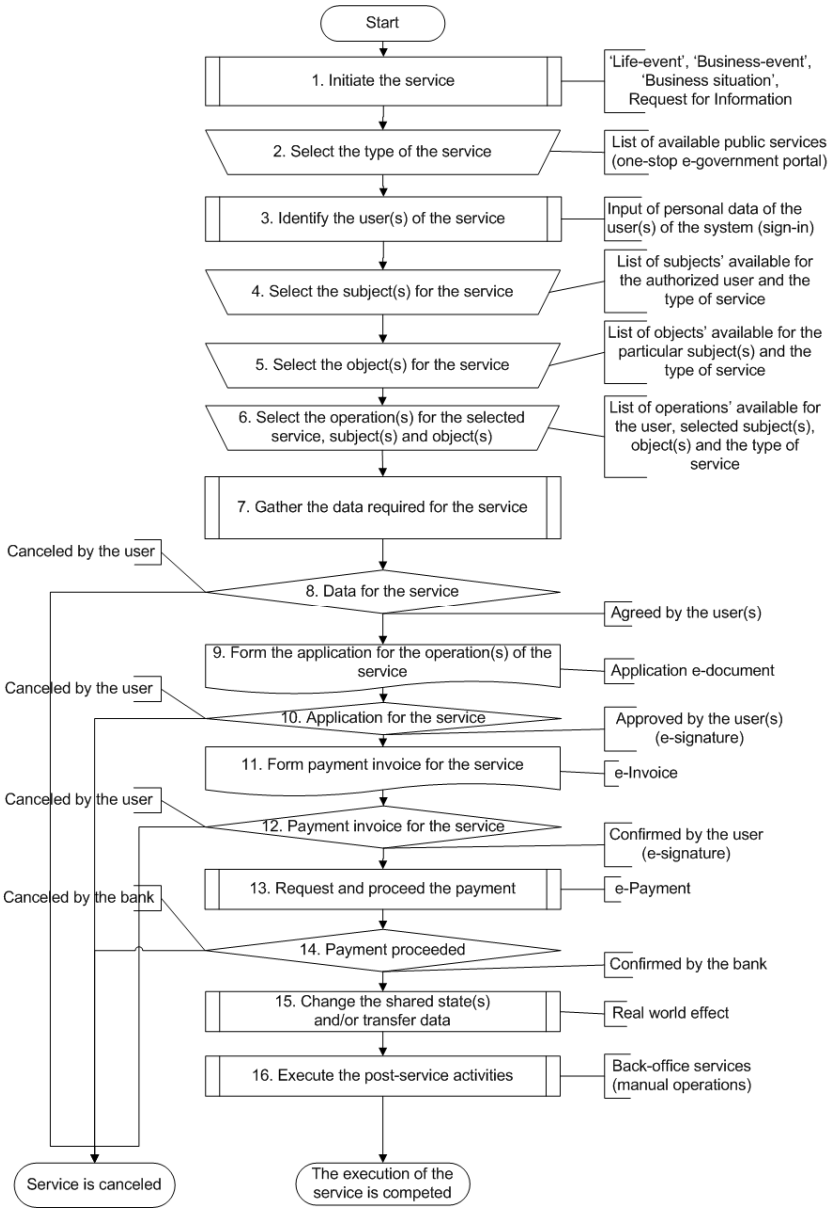

Figure 2. Procedure of an e-service in public sector

5. Selecting the object(s) of the service means the choose of the particular object from the list of objects‘ available for the particular customer and for the type of service that was selected (e.g. particular vehicle). Agent or the organizational representative may represent many customers but may access the objects of the particular customer only when they deliver the service to him or her.
6. Selecting the operation(s) for the service means the choose of the particular operation(s) from the list of operations‘ available for the selected particular object, the service initiator and for the type of service selected (an operation we mean the subdivision of the particular type of service; the type of service may be combined of one or more operations; operations cannot be subdivided). There should be a possibility to select one or more operations that can be logically executed together for the particular service (e.g. change of the owner address and/or the vehicle plate number).
7. Gathering data means that all the data that are needed for the service and that are electronically accessed should be gathered in automatic way. Other data that cannot be accessed electronically or not available should be entered manually. Depending on the specific of 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 – number plates and registration license; input of the phone number, e-mail address for the communication) or entered by the 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 certainty of the entered data that are based on the original documents that were presented.

8. All the gathered data are to be presented to the user(s) that is working with the system and he/she should confirm them or refuse if he/she notices wrong or unsatisfactory data.
9. If the data are confirmed the electronic application for the service is to be formed in automatic way (application in our context means some kind of contract between the service consumer and service provider). It is optional depending on the type of the service and is formed 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 it or refuse it if he/she changes his/her mind or because of other reasons (e.g. the price for the service is too high).
11. If the application is approved and the specific of the service requests the electronic invoice for the payment of the service is to be formed. The e-invoice is to be formed in 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 working with the system and he/she should confirm it or refuse it in case of any reason. Confirmation means that the user agree to pay the specified sum for the service.
13. If the e-invoice is approved the system send the request to perform the e-payment transaction to the bank that was specified by the user.
14. When the e-payment is executed it could be confirmed or canceled by the bank.
15. After the bank has confirmed the e-payment the execution of the service has to be started. The automatic part of the execution may cover only these two functions: the change of the status of the object(s) and/or subject(s) that were selected, and/or data transfer(s) (e.g. change of vehicle registration status; transfer of data of a new owner to the vehicle register). The instructions for the manual execution of the service activities that cannot be executed in automatic way should be formed (e.g. print the vehicle registration certificate and deliver it to the customer).
16. If the instructions for the manual activities are formed they must be executed to finalize the service delivery.

The activities (or elements of the processes) in the presented procedure are sequenced in a hard logical sequence taking into account business process samples that were acquired in practical experience. But there are possible exceptions that could be 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 the features that follow. First of all – scalability, flexibility and reusability: it should be easy and simple to make changes that depend on the particular changes in business processes and situations. Changes in such systems should be focused just in modifying, changing or adding the components of the system without any intervention into the core or other elements of the system. There should be possibility for use of the elements of common interest from the systems of different administrations. Second 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 needed elements for such a system even when the elements may be provided as independent services from the systems of different administrations or organizations. Finally – manageability: it should be simple to manage the integrated elements and the system itself.

3 SOA BPM application for e-service development

We focus on SOA design technique based on services [1, 10] in this paper. It is important to recognize that this paper does not encompass the mechanism used to deliver an individual service rather than its purpose is to cover how SOA can be used from logical point of view.

An abstract view of SOA can be represented as a set of logical layers [2], where the given layer does not entirely depend upon the layer below it. This architectural approach completely isolates and encapsulates the implementation details (technologies, infrastructure). This 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 consumer layer as the highest. The middle layers consist of service components, services and business processes layers.

The consumer (or presentation) layer provides the capabilities 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 times 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.

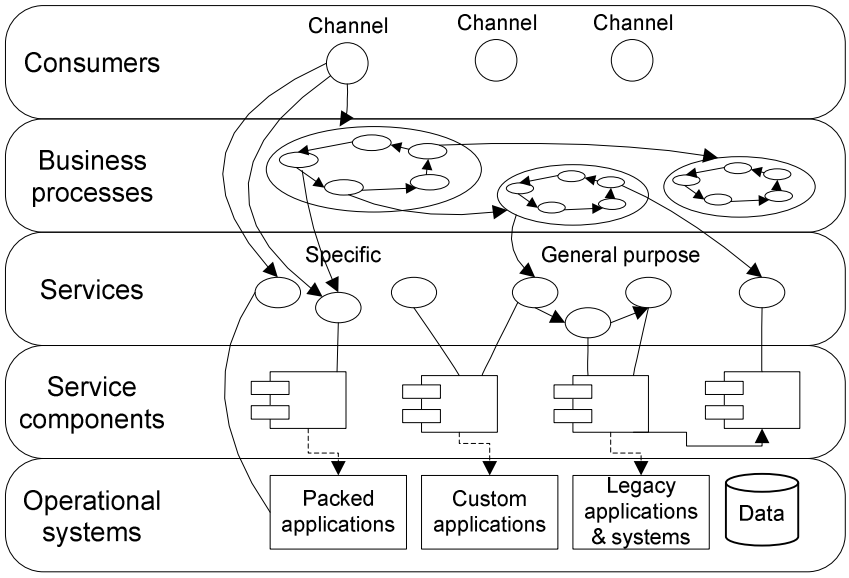

Figure 3. SOA layered model

The business processes are created due to choreography and composition of business services, which are 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 business process layer plays a central coordinating role in connecting business-level requirements and IT-level solution components.

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, e-documents forming) and specific services (e.g. process management, list of subjects/objects/operations forming, operation price forming, 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 to better leverage 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 for, 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.

According to 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 flexible, decoupled functionality that can be reused. Summing up, implementing SOA can bring the following benefits [2]:

- **Increased flexibility and reusability**. The applications, based on services are created in such a way as to facilitate the rapid restructuring and reconfiguration of the business processes and applications that consume them.
- **Added business agility**. Delivers 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.
- **Increased consolidation**. Integrates IT systems across legacy, packed, custom and new applications and organizations.

- **Alignment of business and IT**. SOA bridges the gap between business and IT.
- **Reduced cost**. SOA provides the opportunity to consolidate redundant application functionality and decouple functionality from obsolete and increasingly costly applications.
- **Increased revenue**. Provides the opportunity to enter into new markets and 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.

4 Conclusions and future works

Contributing in modeling complex governmental processes a generic e-service model for the services in public sector was presented. Modeling approach enables structured representation of a problem: in a divide and conquer manner one can identify several parts of a problem (divide) and independently analyze single parts (conquer) without losing the whole context.

The generic e-service model can be used: to model services in public sector promoting one-stop e-government solutions, to create system architecture for e-service development, as a tool for benchmarking of services in comparing of different or particular types of services, and can help the authorities to understand the ways of automation, enhancement and integration of business processes to help them realize their e-services.

The benefit of using the model for e-service and system development is expected: it is likely that the usage of the common model in realization of the online one stop e-government will increase the efficiency and effectiveness of the administration activities in public sector, will promote development of a standard for public sector's service provision, and will increase the quality of public services.

A SOA BPM application is proposed for the development of e-services according to the proposed model. The SOA architectural solution establishes the main set of architectural blocks such as services components, services and flows that support business processes and the business goals. The major capability afforded by SOA solution is the increase of reusability while designing and developing solutions that enables continuous process improvement and development circle.

Future works that are planned are focused to the further development of the model in seeking of standards of the e-service model, to checking the conformance of different e-services to the model, to the evaluation of the maturity and complexity of e-services, to the comparison of e-services of the same and/or different types.

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