SERVICE ORIENTED ARCHITECTURE IMPLEMENTATION IN LATVIA DEVELOPED SOFTWARE

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Abstract. Currently a few integration and e-service development projects are started in Latvia. One of them is Integrated State Information System (ISIS, Latvian abbreviation IVIS), which was started in January 2006. Customer and provider of this project is the Secretariat of Special Assignments Minister for Electronic Government Affairs (SSAMEGA)). This project solution forms the infrastructure for e-service development. The infrastructure is already accessible for e-service designers and developers since the middle of 2007. There are more than 30 e-services, which were developed using ISIS infrastructure, already accessible for Latvian inhabitants on Latvian government e-service portal (www.latvija.lv). ISIS is based on Service Oriented Architecture (SOA) principles and includes many individual innovations and modern solutions. This paper describes development architecture and innovations, which are used in ISIS solution and in current government projects.

Keywords: E-government, e-service, SOA, XML, URN.

1 Introduction

Development of technologies all the time provides new and effective methods which allow improving the work of data procession as well as mutual exchange and integration. These are important processes which have to be considered in planning and development of State Electronic Administration because in work of state administration several substantial registers are used where data about objects and subjects existing in their contents as well as about services which the state has to provide according to legislation are stored. Development of electronic services and implementation of state electronic administration is one of priorities in almost all countries of the European Union and in the most developed countries of the world including Latvia. It is substantially important to have e-administration and integration process organized, not chaotically. Now there is no centralized coordination of information system integration process in Latvia. Previous decade can be relatively considered as the time when the primary data registers were developed. The new decade obviously will be more orientated to integration of these registers, electronization and availability of services provided to inhabitants. Nowadays all developed countries of the world proceed this way.

Before development of Integrated State Information System (ISIS, IVIS in Latvian) the experience of the world and the Baltic countries has been taken into consideration. Lots of attention was paid to Estonian X-Road system [1]. ISIS is based on successfully applied principles of X-Road: definition of centralized data exchange point, standardized data exchange formats and protocols. The main difference is that ISIS tends to use already existing state registers and infrastructure of information system data exchange if it exists. At the present X-Road integrates 150 databases and information systems and are widely applied, but application of ISIS at the present is only for delivery of e-service functionality.

The article's authors have participated in development (system analysis, design, coding, and integration) of ISIS system from the very beginning, and have ensured successful defence of the system publically in Riga Technical University State Qualification Commission. During realization stages of the system there were invented and applied definite original solutions:

- were applied SOA (Service Oriented Architecture);
- e-service and identification standard;
- application of joint standards in state level in development of e-service and integration projects;
- application of centralized XML schemes, Information System (IS) services, e-services and usage of public service catalogues and others.

As mentioned above ISIS solution was partly included in successfully defended Master Paper and proceeds to be developed during development process of Doctorate work.

By use of ISIS infrastructure there were some projects developed. Solution architecture of ISIS and some of related projects are described further in this article.

2 ISIS development principles

There was time when in the integration was applied principle: each system has to be integrated with other each system. Now this time has passed and nowadays this approach is not allowed because that means technological deadlock. Information is stored in databases, the amount of which continuously increases. Realization technologies of databases are different therefore if independent integration methods of technological platforms are not applied problems of technical compatibility occur very often. Communication infrastructure which is used for interconnected exchange of information are in different technical condition, that does not give guaranties for communication continuity, therefore integration software has to be able to process situations both when communication channels become very slow or unavailable. This situation determined selection providing definite technological solution which is based on the following principles:

- technological standard of integration has to be universal, it means, it has to be independent of different technologies of various software producers;
- integration standard has to be based on the best experience of the world and it has to comply with that what is now accepted and developed in international IT companies;
- integration software has to be scalable: with possibility to increase its performance without complicated re-programming works actually decreasing „down time" by the minimum because this software infrastructure will be a base for implementation of e-services and in the future continuous increase either in electronization of services and intensity of their usage are planned;
- integration software has to be with producers guaranteed development in perspective;
- since at the same time integration software will be also environment where e-services will be implemented it has to have possibility either to modify or produce new e-services investing as small amount of programming work as possible.

ISIS solution includes better implementation methods from similar e-administration integration systems such as in Denmark [2], Great Britain [3], New Zealand [4], Hong Kong [5] and elsewhere.

3 Survey of ISIS solution

ISIS provides possibility to mutually integrate information systems of state and municipalities which already are or will be in the future providers or receivers of various e-services including different portals from which e-services will become available for inhabitants. In development of e-services will take part not only state or municipal institutions but also commercial organizations - for instance, banks, which will be necessary to attract to realization of e-services with charge.

ISIS solution was established basing on the following principles:

- were applied SOA (Service Oriented Architecture) [6];
- solution technologically supports integration with many e-service providers;
- e-service and identification standard which ensures assignation of unique numbers in the world level;
- application of joint standards in state level in development of e-services and integration projects – development standards of XML schemes [7], development standards of IS services [8], development standards of e-services [9], SOA standards;
- development of four centralized catalogues: catalogue of XML structures, catalogue of IS services, catalogue of e-services, and catalogue of public services;
- common use e-services and IS services are technologically available from many access points – state and municipality portals, web pages of institutions etc.;
- usage of e-service envelope in asynchronous e-service implementation;
- employees of institutions and inhabitants will be provided with safe mailbox with possibility to perform intended tasks of e-service implementation process;
- data distribution network (DDN) – safe communication channel among managing information systems which is comfortable for asynchronous transmission of large data amount.

ISIS solution architecture comprises the following base elements:

- hierarchy of XML structures;
- IS service;
- e-service.

Conceptual description of ISIS solution is available [10].

3.1 Conceptual model of ISIS system

Conceptual model of ISIS system is illustrated in Figure 1.

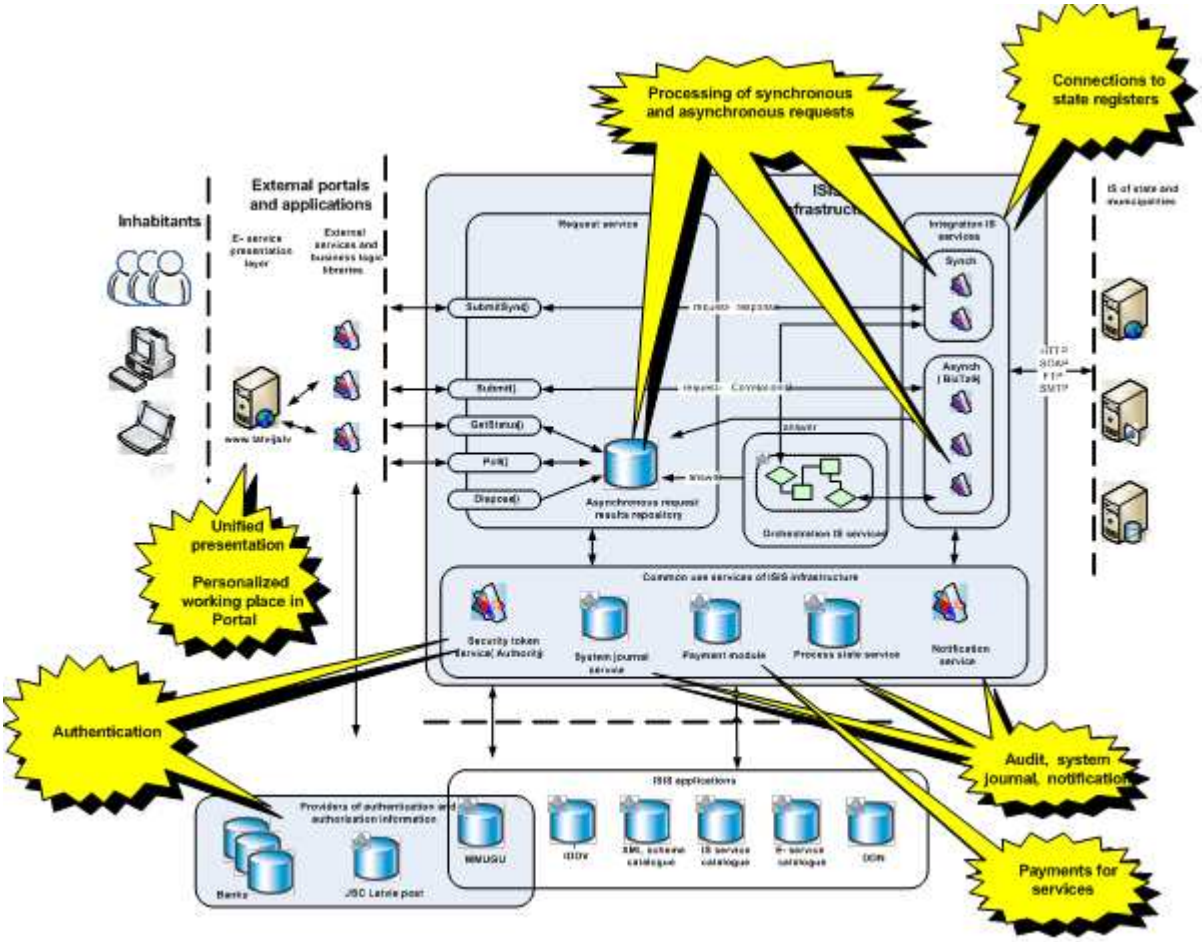

Figure 1. Conceptual module of ISIS system

Platform for e-service implementation are made by several components which are:

- external portals and application which are made by:
  - e-service presentation layer;
  - external services and business logic libraries.
- ISIS infrastructure which is made by:
  - request service;
  - common use services of ISIS infrastructure;
  - integration IS services;
  - orchestration IS services (IS services made on BizTalk base what ensures operation of asynchronous and multi-step e-services);
  - business IS services.
- Providers of authentication and authorization information: management module of ISIS users and groups of users (MMUGU), inhabitants' accounts of state portal, safe electronic signature of JSC Latvia Post;
- ISIS applications;
- IS of state and municipalities.

Description of elements of ISIS conceptual model is available in [10].

3.2 Hierarchy of XML structures

Data exchange between e-services and IS services is maintained by use of standardized and confirmed XML data structures which are included in centralized and publically accessible catalogue of XML structures.

Organizational way of XML data structures is hierarchy, and data structure described in XML language can be included and re-used in other data structures as shown in Figure 2. Centralized maintenance and well-considered development of hierarchy of XML data structures will ensure that each e-service or IS service will not need to produce separate special data structure but more often data objects (for example general personal data, general data of addresses etc.) will be repeatedly used in many of e-services and IS services.

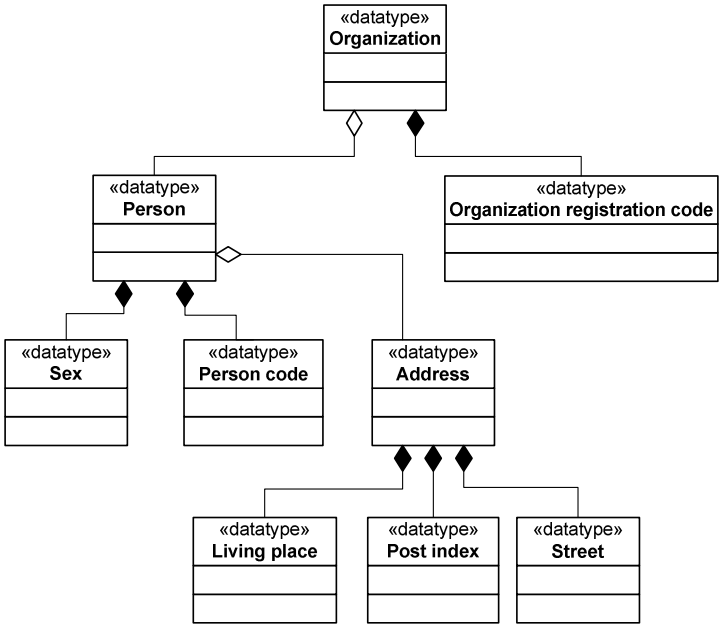

Figure 2. Hierarchy of XML structures

3.3 IS service

In ISIS architecture IS services means external interface by information resources. Information resource is register of every state agency or municipality, information system or database. The primary aim of each such register or IS is to ensure concrete, specific functions which the appropriate institution has to perform. IS and DB, which are used in institution are selected, developed and optimized specially for requirements of this specific institution, and they can not be oriented to possibility for others to receive information. But in the case if such possibility is intended it can be very specific and with different limitations.

IS service ensures:

- connection interface for information resource data;
- black box which has specific range of functions as well as – input and output parameters;

IS service realization has two parts – server part and client part:

- server part – IS service realization in IS institution side (selection of realization type is the competence of institution, it is desirable to describe interface according to standard WSDL);
- client part – IS service interface realization in IS services catalogue side; ensures necessary auditing and performance of WS-Security request.

Determined requirements for IS service:

- It has to be prepared according to specified IS service standard [8] which is benefit of ISIS project standardization phase;
- It can be used for parameters and results only pre-specified and published XML schemes.

Implementation of IS service server part is performed according to one of the following scenarios:

- On the base of SOAP with WSDL description and according to specification is established IS service which uses predefined XML data type. It is provided special, in state level agreed, XML format for delivering of information resources, respectively, to receive necessary data;
- For linking of existing system already existing information transfer gateway or protocol and format are used. In this case integration solution will need to adapt to information sources. In result of linking implementation it is necessary to realize Web service which complies with requirements mentioned above and which is able to participate in construction of integration routes. Thereby in the construction of integration routes participate only these Web services which simplify solutions in totally and ensure their uniformity;
- merge of both above mentioned approaches.

3.4 E-service

E-service is on-line service ensured by state or municipality which is used by inhabitants, enterprises or state institutions. Applied architecture ensures possibility to provide the same e-service by use of unlimited number of entry points for example State portal, ISIS e-service portal and web pages of municipalities. Procedure of e-service provision is divided into three logical elements (layers):

1. E-service user's interface (Internet browser, for example Internet Explorer 6.0).
2. E-service presentation interface (Web server of the portal), which by use of ISIS provided IS services IS, reprocess received XML (only data) with one of transformation processes (for example XSLT) and in the result produce HTML file (XML data representation) what is sent to client's browser.
3. Integration process of e-services which realizes linkage with registers and by use of IS service interface prepares e-service files of XML format with data. Usually in the service data from several state registers are used with possibility to use already developed IS services again.

E-service is performed in Web server of appropriate portal ensuring required call of IS services. Each portal which participates in process of e-service rendering, are given the following obligatory requirements:

- authentication and authorisation of users (inhabitants);
- payment of state duties (if necessary);
- users interface which ensures possibility for inhabitant (portal's user) to answer specific with e-service related questions which were additionally asked by institution employees about e-service performance (for complicated services);
- other requirements what will be stipulated in document of e-service development guidelines and e-service standard [9].

ER chart of e-services is shown in Figure 3.

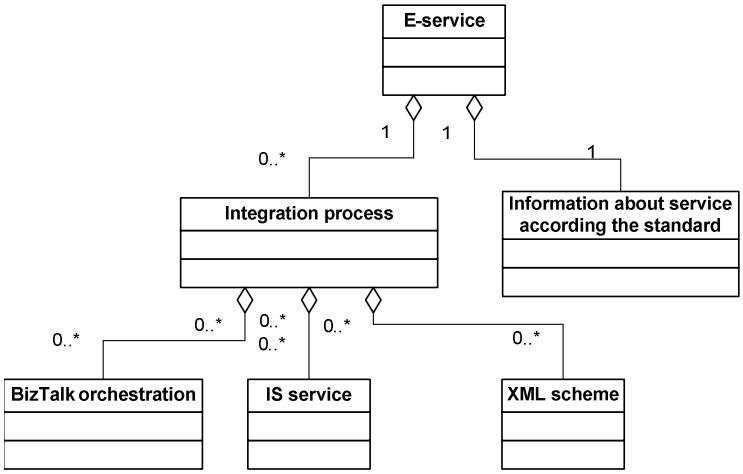

Figure 3. ER chart of e-services

4 Data distribution network

DDN is subproject of development of ISIS infrastructure and ensures provision of G2G type services. It realizes virtual environment where institutions are able to regulate auto communications between information systems (IS). Institutions (institutions which are registered in ISIS system) IS can exchange messages. These messages are in XML format which is predefined. Communication is established by use of virtual channels.

4.1 Motivation

In Latvia – as well as in the other countries in the world – there exists serious problem: inclusion of actual (and actualizing) data in one specific Web site (register or information system) make difficult access to these data and their usage – communication channels are overloaded with this site.

In the world this problem is solved by data replication:

- data are copied outside original storages;
- copy is synchronized with its original – if the data are actualized in their original site, they are automatically actualized in all of their copies.

Data replications are realized in different ways using various tools, guides and approaches – there is not joint standard in the world how to realize it. To realize each data replication as individual solution is not possible because it does not correspond to ISIS strategy and is not acceptable also because:

- it encumbers management and administration of these multi-kind replication;
- implementation initiatives for IT are too expensive.

DDN forms centralized solution for general provision of data replication as shown in Figure 4.

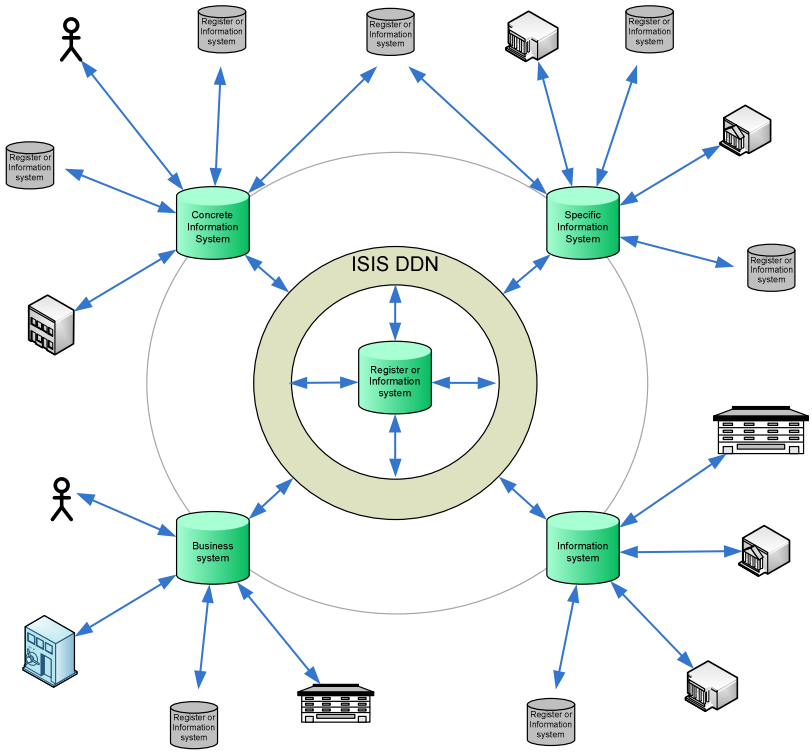

Figure 4. Aim situation what will be ensured by integration of DDN infrastructure

4.2 Solution description

DDN logic is shown in Figure 5.

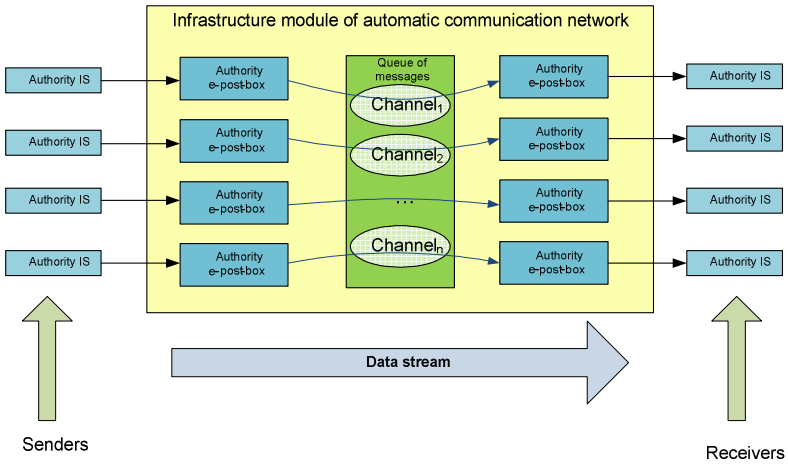

Figure 5. DDN logic

Each channel has one owner and from 0 to N subscribers. Owner – institution which developed the channel. Subscriber – institutions which the owner has linked to the channel. The message flow of any channel has two directions:

- the main direction where the primary messages are sent;
- opposite direction for feedback (failure messages).

Institutions can form their own channels or subscribe already formed channels. Institution–owner selects type of message for each channel which this channel passes through. Each institution has formed their e-mailbox. Operation principles of e-mailboxes are similar to those which are used by popular e-mail systems. The difference is in class of users – these mailboxes are rather intended for information systems and automatic communications than for a human. Information systems – the main users of mailboxes – send/receive messages by use of mailbox WEB services. The role of human in the work with DDN mailbox is directly administrative.

There are two types of channels:

- data distribution channel (DDC) (see Fig.6) where the main direction is from owner's institutions–subscribers. Owner sends the primary message to channel (addressing to no-one concretely but to the channel) – subscribers receive exemplars of distributed message in their e-mailboxes. If any of subscribers has a need to give feedback (to inform about failure), they can give answers to received messages. The owner receives messages;
- data collection channel (DCC) (see Fig. 7) where the main direction is from subscribers to owner. Subscriber sends the primary message to channel – owner receives the distributed message in his e-mailbox. If owner occurs need to give feedback (to inform about failure), it gives answer to received message which the appropriate subscriber receives.

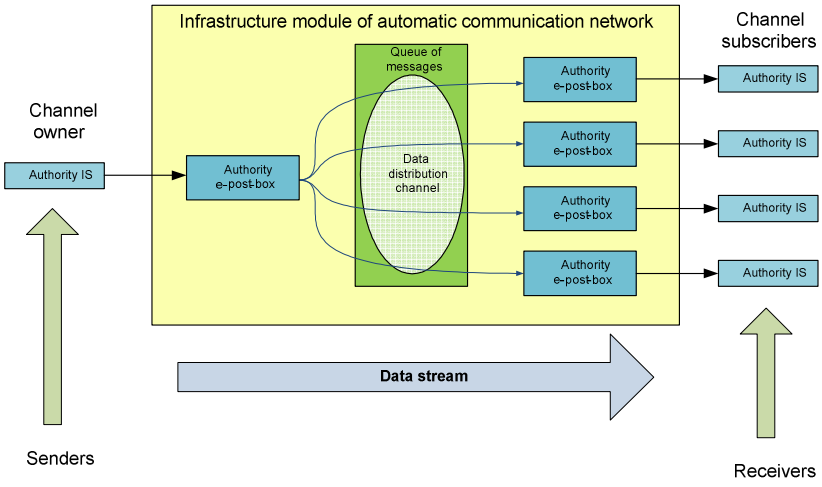

Figure 6. Data distribution channel and its context

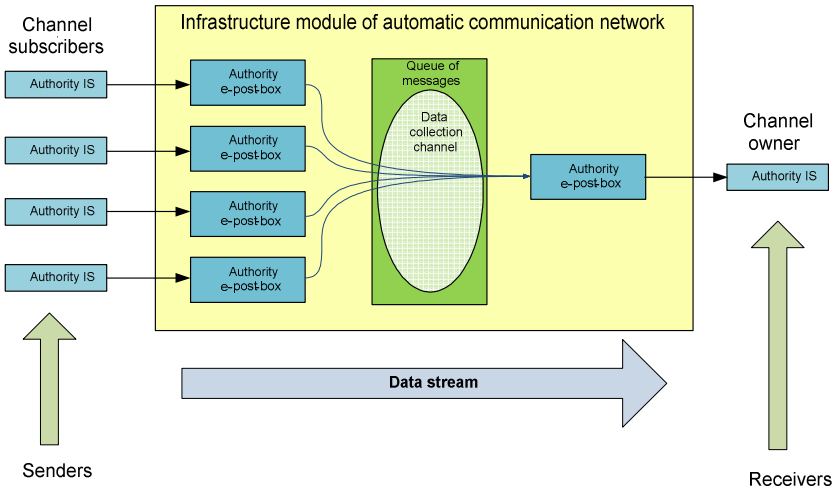

Figure 7. Channel of data collection and its context

5 Conclusion

The aim of e-service infrastructure implementation is to realize environment where it is possible to realize e-services rapidly and with minimal amount of programming work. At the present practical advantages of

ISIS are formations of many public services which are already accessible in portal www.latvija.lv. Realized infrastructure is formed on SOA principles using experience of world and Baltic States.

The formed e-service infrastructure ensures:

- increased quality and accessibility of state and municipality services (increase of customers comfort and time economy);
- increased effectiveness and transparency in work of state and municipalities institutions (rational usage of state and municipality assets);
- secured comfortable and convenient order of service delivery for customer (standardized interface, additional services for inhabitants – safe mailboxes, payments);
- secured accessibility of services by use of different service provision channels related to specific customer's requirements namely customer service centres, telephones, Internet, etc.
- For implementation of e-service infrastructure are expected the following positive results:
- possibility to decrease total costs of state and municipalities in IT field implementing centralized services and solutions;
- possibility to increase integrity and compatibility of new projects implementing centralized infrastructure;
- possibility to improve administration and coordination of national IT systems development;
- possibility by implementation of joint standards to ensure independent development of separate services.

With the development of e-service infrastructure project would gather also information about problems and risks in its implementation; during realization of project some recommendations for usage and adaptation of SOA occurred:

- technological standard of integration has to be universal, it means that it has to be independent of different technologies of different software producers;
- integration standard has to be based on the best experience of the world and it has to comply with that what is now accepted and developed in international IT companies;
- integration software has to be scalable: with possibility to increase its performance without complicated re-programming works actually decreasing „down time" by the minimum because this software infrastructure will be a base for implementation of e-services and in the future are planned continuous increase either in electronization of services and intensity of their usage;
- integration software has to be with producers guaranteed development in perspective;
- it is necessary to use BPEL based solutions for integrated e-service development what ensure integration of several services and performance of asynchronous processes.

Unequivocally can be concluded that at present there are no technical or technological problems but there exist problems of administrative or procedural type which feature solution implementation in all state levels. Positive and negative aspects of ISIS infrastructure will be researched in more details during development of Doctorate work.

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