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Building eGovernment model on the principles of new economy trends and international standards considering protection of citizen privacy and personal data

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Abstract: **In the era of the „rise of the networking society" and New, digital economy building, eGovernment model presents the next step in connecting the public administration to the citizens in order to meet their needs on the higher level. Benefits of eGovernment modeling getting closer to the citizens and facilitating access 24 / 7 are unmeasureable. However, on the other hand, opens a Pandora's box if the model is not developed on the principles based on procedures that ensure effective protection of personal data stored in government databases, and therefore privacy of citizens what is the main topic this paper.**

Key words: **eGovernment, new economy, standardization, data privacy**

1. INTRODUCTION

In writing, "eGovernment"[1] model, by definition, is a powerful mean of providing more efficient and better quality public services, reducing waiting times for users and improving transparency and accountability in services expresses the use of information and communication technologies (ICT) [2]. As well in public administrations combined with organizational changes and new skills. [3] It finds the objective to improve public services, democratic processes and public policies bringing it user-friendly to the citizens.

The process of eGovernment is one of the priorities since it was set by the eEurope 2005 action plan. The good practices from EU[4] to harness the full potential of eGovernment, it is necessary to identify the obstacles which are slowing down the rate at which on-line public services are being made available and to propose action to speed up the deployment of eGovernment. Especially, security and protection of personal data which is of the greatest importance.

[1] e-Government (from electronic government, also known as e-gov, digital government, online government or in a certain context transformational government) refers to government's use of information and communication technology (ICT) to exchange information and services with citizens, businesses, and other arms of government. e-Government may be applied by legislature, judiciary, or administration, in order to improve internal efficiency, the delivery of public services, or processes of democratic governance. The primary delivery models are Government-to-Citizen or Government-to-Customer (G2C), Government-to-Business (G2B) and Government-to-Government (G2G). The most important anticipated benefits of e-government include improved efficiency, convenience, and better accessibility of public services. (From Wikipedia, the free encyclopedia - http://en.wikipedia.org/wiki/E-Government)

[2] Information and communication technologies (ICT): the term ITC covers a wide range of services, applications, technologies, devices and software, i.e. tools such as telephony and the Internet, distance learning, television, computers, and the networks and software needed to use these technologies, which are revolutionising social, cultural and economic structures by creating new attitudes towards information, knowledge, working life, etc.

[3] Acitivities of European Union http://europa.eu/scadplus/leg/en/lvb/l24226b.htm

[4] Abbreviation for European Union

Progress has been made in Croatia in bringing on-line population as well as progressive growth of public services online. Figure 1. shows the progress of online availability of public services in Croatia from 2004 to 2006.

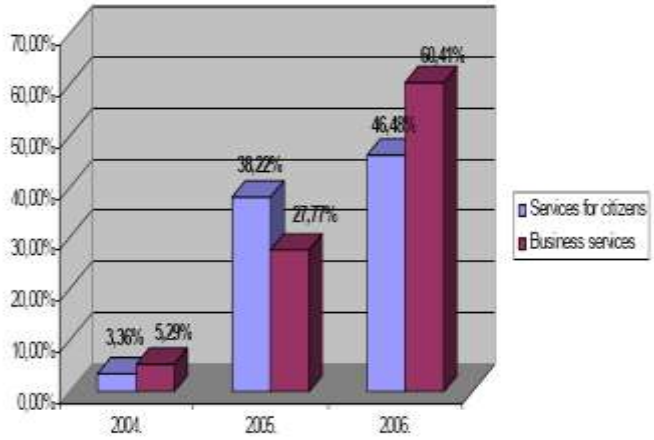

Fig. 1. Progress of online availability of public services in Croatia from 2004 to 2006[5]

In terms of services to citizens, eGovernment has already shown the advantages which it can bring in citizens' everyday lives. It not only makes it easier to obtain information from public administrations but also greatly facilitates formalities for members of the public and cuts waiting times. Beyond that, eGovernment fosters direct communication between citizens and policy-makers. Through online forums, virtual discussion rooms and electronic voting, citizens can directly question decision-makers and express their views on public policy. Today public internet access points are gradually becoming the norm for services to citizens[6].

As regards services to businesses, provision of higher quality electronic services by public administrations leads to increased productivity and competitiveness, by reducing the cost of the public service itself as well as transaction costs to businesses (time and effort). For example, electronic customs and VAT handling and electronic tax declarations offer the advantage of speeding up procedures at the same time as improving quality of service. [7]The sophistication of online services, in terms of supporting interactivity and transactions, has advanced more in the business sector than in services to citizens.

In the case of services between administrations, eGovernment can provide ways to strengthen cooperation between national, regional and local government and Community institutions. Regional and local administrations are often at the forefront of the delivery of on-

[5] Gfk Group: Public services on the Internet –obstacles for utilization and priorities forinformatization. September 2006. Retrieved May13, 2007, from http://www.e-hrvatska.hr/repozitorij/dokumenti/downloads/Istrazivanje_prioriteta_i_prepreka_u_koristenju_javnih_e-usluga.pdf

[6] Abramson, Mark and Means, E. Grady (Editors), (2001), E-government 2001, Rowman and Littlefield Publishers, Inc., New York.

[7] Holmes. D (2001), eGov: eBusiness Strategies for Government, Nicolas Brealey.

line public services. Development of eGovernment at regional and local level has also become a priority of the Structural Funds, representing about 30% of Information Society expenditure in Objective 1 regions and 20% in Objective 2 regions.

2. OBSTACLES TO PROTECTION OF PERSONAL DATA IN EGOVERNMENT MODEL

There is a number of priority issues which have to be addressed in order to remove the obstacles to secure model of personal data and their protection in eGovernment: *inclusive assess, public procurement and user confidence.*[8]

Access for all to online public services is a sine qua non for wide use of eGovernment. This point is all the more important considering the very real risk of a "digital divide" - due to unequal access to information and computer technologies. In this context, education and training are essential to acquire the digital literacy necessary in order to reap the full benefit of the services offered by eGovernment. Greater access to services also implies stepping up the multi-platform approach (allowing access to services through a range of devices, from PCs and digital TV to mobile terminals or public internet access points). The next step of eGovernment is called mGovernment as in Mobile Government concerning the growth of mobile industries. Advances in eGovernment oriented technologies and services are taking place with a considerable speed around the world. eGovernment efforts aim to benefit from the use of most innovative forms of information technologies, particularly web-based Internet applications, in improving governments' fundamental functions. These functions are now spreading the use of mobile and wireless technologies and creating a new direction: mobile government (m-government).[9]

Public services can be offered on line only in an environment guaranteeing fully secure access for citizens. With this in view, maximum protection of personal data and security of digital transactions and communications are primary issues. To this end, the use of privacy enhancing technologies in eGovernment should be promoted. More generally, network and information security, the fight against cyber crime and dependability are prerequisites for a properly-functioning Information Society and, consequently, are core policy issues within the European Union. In Croatian legislative until now the absence of clear rules has been an obstacle to the take-up of electronic public procurement in facing the eEurope programme in order to become EU member. So, the current situation gives the determinations of legal acts but still they haven't taken their place in legal practice.

In the future, public procurement is one area where use of ICT can be particularly advantageous. Traditional public procurement operations in Croatia are complex, time-consuming and resource-intensive. Use of ICT in public procurement can therefore improve efficiency, quality and value for money in public purchases. The adoption of the new package of legislation on public procurement, which includes specific rules on electronic public

8 Communication of 26 September 2003 from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions "The Role of eGovernment for Europe's future" [COM(2003) 567 final - Not published in the Official Journal].

9 I. Kushchu and M. H. Kuscu (2003). "From e-Government to m-Government: Facing the Inevitable". The 3rd European Conference on e-Government: 253-260.

procurement, should be a turning point for the spread of electronic public procurement in Europe. Also, the question of personal data and its protection is of the highest priority in this matter.

Interoperability, in definition gives the capacity to inter-link systems, information and ways of working. This kind of interoperability of information systems allows integrated provision of services in a one-stop portal (for example one-stop-shops[10] at HITRO.hr[11]) no matter how many different administrative systems or bodies are involved. But interoperability is not just a question of linking up computer networks: it also concerns organizational issues, such as networking with partner organizations which may well have different internal organization and operating methods. Introduction of eGovernment services in eCroatia 2007 programme also inevitably requires agreements on common standards and specifications. This challenge by adopting national "eGovernment interoperability framework" is developed in order to be complemented at European level by the development of the European interoperability framework[12].

In Croatia the Croatian Standards Institute is responsible to develop and align its standards to recommendations of international organizations for standardization. So far, some open standards are accepted to be implemented, such as Web Content Accessibility Guidelines 1.0 (implemented on all public administration web sites in 2007) developed and maintained by World Wide Web Consortium (W3C), standards for e-business developed and maintained by the Organization for Advancement of Structured Information Standards (OASIS), etc. Croatia is also started to develop an interoperability framework for several segments of public administration (The Customs Administration, The Tax Administration, Spatial Data national infrastructure) to join national information systems (IS) with ISs of EU countries[13].

3. PRIVACY AND SECURITY OF PERSONAL DATA: PRIORITY ISSUES OF EGOVERNMENT MODEL

Privacy is one of the most important issues facing the Internet. Governments must be responsible custodians of the enormous amounts of personal information they hold. Governments collect vast quantities of data on their citizens through everyday transactions.

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10 One-stop portal: a single entry point to the Internet for a specific topic which can be used without any knowledge of how the administrative departments involved in providing the public service are organised.

11 HITRO.HR comprises of several services: the establishment of Limited Liability Company, e-Regos (The Central Registry of Insured Persons), e-Tax, e-VAT, e-Pension, e-Craft, e-Cadastre, and e-Corner.Majority of the services mentioned require authorizationfor accessing the service and authentication of forms by applying smart cards with a digital certificate issued by the Financial Agency.

12 Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, i2010 eGovernment Action Plan - Accelerating eGovernment in Europe for the Benefit of All [COM(2006) 173 final - Not Published in the Official Journal]. This Action Plan, adopted in 2006, is designed to introduce more efficiency in public services, to modernise them and to target the needs of the population more precisely. It proposes a series of priorities and a roadmap to speed up the deployment of eGovernment in Europe.

13 T&MC, e-Hrvatska: Benchmarking study on online availability of public services - third research for year 2006 (presentation for the press, in Croatian), Retrieved July 13, 2007, from www.e-hrvatska.hr/

As e-government services grow in scope and popularity, those databases will expand in size and detail. Protecting the privacy of citizens' personal information stored on these databases while making effective use of the information contained in them is a vitally important issue, one which policymakers must address if citizens are asked to entrust sensitive personal, financial and medical data to the government in order to utilize Internet-based e-government systems.

To avoid the privacy risks it is necessary to educate and train the government officials on the importance of privacy. The software applications of eGovernment model should integrate privacy protections and minimize the collection and retention of personal information. Limited access to personally identifiable information is also the important way of protecting privacy.

Government websites and online services must adhere to privacy best practices. Privacy must be addressed in the planning and design of e-government systems since it is much harder to interject privacy protections after a system is built. Government websites and online services should fully comply with the fair information principles outlined.[14]

Security of personal data in e Government model is costly process, but it is important to be addressed in the design phase, as security breaches can shatter public trust in eGovernment model. Without trust, citizens who may already be leery of using technology may avoid and even shun the use of online services that ask for detailed personal information. It is a vitally important component of every eGovernment project.

Security Recommendations[15]:

• Designate a senior official responsible for computer security.

• Continually assess systems to make sure that security precautions are being implemented.

• Backup information regularly and store backups in a separate location.

• When it comes to personal information, keep information collection to a minimum and do not disclose personal information without express prior consent.

• Provide ongoing training to employees on computer security.

• Evaluate performance of system managers in adhering to sound security practices.

Government transparency should also be embedded in the design of ICT systems. Citizens too rarely understand how government decisions are made. This lack of transparency prevents the public from actively participating in government and from raising questions or protesting unfair or ill-advised decisions. A lack of transparency can conceal official graft or favoritism.

The model of eGovernment seeks to use information and communications technologies to improve the quality and accessibility of public services. But also it is dealing with a great risk of security of citizens personal data. When designed properly, it can reduce costs for businesses and administrations alike, and facilitate transactions between administrators and citizens. Training and educating of government employees, integrating the transparency and simplifying the regulations and procedures by putting the services online helps to make the public sector more open and transparent and governments more understandable and accountable to citizens.

[14] Lanwin, Bruno, (2002) A Project of Info Dev and The Center for Democracy & Technology: The E-government handbook for ddeveloping countries. [online] http://www.cdt.org/egov/handbook/2002-11-14egovhandbook.pdf

[15] Ibidem

Fifth annual study of e-Government of European Commission[16] stated out that more than 90% of public service providers now have a website, and 40% of basic public services are totally interactive. The survey highlights the considerable progress made in developing and providing on-line public services throughout the EU. The gap between the new Member States and the EU-15 States in terms of service provision has narrowed significantly, and could close very quickly. The challenge now is to ensure that on-line public services are used as widely and as often as possible so as to simplify the administrative procedures for businesses and citizens alike.

According to the results of Fourth annual study[17] of e-Government public administrations which combine the use of ICT to deliver new services with reorganization of the way they work obtain higher approval ratings from businesses and citizens. This large-scale survey, funded as part of the evaluation of the eEurope action plan, was conducted in every EU Member State, looking at a common list of 20 basic public services which should be available on line under the action plan. The survey included 29 in-depth case studies of "best practice", for example substantial savings in enrolment in higher education in Finland and the United Kingdom.

The Commission concluded[18] that the better results are due to the fact that reorganization plus use of ICT in public administrations reduces costs, increases productivity and provides flexibility and simpler organizational structures. The practical results for the public and for businesses are fewer visits to administrations, together with faster, cheaper, more accessible and more efficient services, but also fewer errors, easier to use systems and greater user control.

4. PROTECTION OF PERSONAL DATA: THE LEGAL ASPECTS

The right to data privacy is heavily regulated and rigidly enforced in Europe.[19] The European Court of Human Rights has given this article a very broad interpretation in its jurisprudence. According to the Court's case law the collection of information by officials of the state about an individual without his consent always falls within the scope or article 8. Thus, gathering information for the official census, recording fingerprints and photographs in a police register, collecting medical data or details of personal expenditures and implementing a system of personal identification have been judged to raise data privacy issues.

Any state interference with a person's privacy is only acceptable for the Court if three conditions are fulfilled: (1) the interference is in accordance with the law, (2) pursues a legitimate goal and (3) is necessary in a democratic society.[20] The government isn't the only one who might pose a threat to data privacy, far from it. Other citizens and private companies

16 According to a 2005 survey carried out for the Commission. The survey also offered a set of recommendations to public online service providers for the further development of eGovernment.

17 Fourth annual study of e-Government an extensive survey published in January 2004

18 Information society –summaries of legislation -http://europa.eu/scadplus/leg/en/s21012.htmLast updated: 28.8.2006

19 Article 8 of the European Convention on Human Rights (ECHR) provides a right to respect for one's "private and family life, his home and his correspondence", subject to certain restrictions.

20 Human Rights Handbook no. 1 (PDF) or the Council of Europe data protection page.

most importantly, engage in far more threatening activities, especially since the automated processing of data became widespread. As the entire member states of the European Union are also signatories of the European Convention on Human Rights and the Convention for the Protection of Individuals[21] with regard to Automatic Processing of Personal Data, the European Commission was concerned that diverging data protection legislation would emerge and impede the free flow of data within the EU zone. Therefore the European Commission decided to harmonize data protection regulation and proposed the Directive on the protection of personal data, which member states had to transpose into law by the end of 1998. In full name, Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data contains a number of key principles which must be complied with. Anyone processing personal data must comply with the eight enforceable principles of good practice.

The personal data must be[22]:

- Fairly and lawfully processed.
- Processed for limited purposes.
- Adequate, relevant and not excessive.
- Accurate.
- Not kept longer than necessary.
- Processed in accordance with the data subject's rights.
- Secure.
- Not transferred to countries without adequate protection

The directive regulates the processing of personal data, regardless if the processing is automated or not. Personal data are defined as "any information relating to an identified or identifiable natural person ("data subject"); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity;" (art. 2 a). This definition is meant to be very broad. Data are "personal data" when someone is able to link the information to a person, even if the person holding the data cannot make this link. Some examples of "personal data": address, credit card number, bank statements, criminal record.

The notion processing means "any operation or set of operations which is performed upon personal data, whether or not by automatic means, such as collection, recording, organization, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, blocking, erasure or destruction;" (art. 2 b)

[21] The Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data was concluded within the Council of Europe in 1981. This convention obliges the signatories to enact legislation concerning the automatic processing of personal data, which many duly did.

[22] Directive 95/46/EC on the protection of individuals

The responsibility for compliance rests on the shoulders of the "controller", meaning the natural or artificial person, public authority, agency or any other body which alone or jointly with others determines the purposes and means of the processing of personal data; (art. 2 d)

The data protection rules are applicable not only when the controller is established within the EU, but whenever the controller uses equipment situated within the EU in order to process data. (art. 4)[23] Controllers from outside the EU, processing data in the EU, will have to follow data protection regulation. In principle, any on line shop trading with EU citizens will process some personal data and is using equipment in the EU to process the data (the customer's computer). As a consequence, the website operator would have to comply with the European data protection rules. The directive was written before the breakthrough of the Internet, and to date there is little jurisprudence on this subject.

In Croatia, the protection of personal data is regulated since 2003. by the Law on protection of personal data[24]. as well as the Law of the right to data privacy.[25]. On the traque of European directives, as the crown of this process, information security is regulated and enforced since 2007. by the Law on information security.

5. BUILDING EGOVERNMENT MODEL ON THE PRINCIPLES OF INTERNATIONAL STANDARDS

There are several international standards that point out importance risk management which is of great importance for building eGovernment model on the principles of international standards.

Among this standards the most renowned are: ISO/IEC 27001 i 13335, COBITv4, ITIL and others less noted ISO 27001:2005 defines Risk Analysis as "systematic use of information for identification of cause and risk evaluation" where under risk is implied "probability that one threat will seize assets vulnerability and cause loss to organization" (eGovernment model in this case).

Risk analysis is integral part of activity that is a lot wider than Risk Management activity focused on risk control to which organization is oriented. In IT sector the goal of risk analysis activity is to perceive and quantify real risks to which Information System is vulnerable to. Risk expresses probability to occur unwanted event to security system with harmful consequence to system. Unwanted event that can cause damage to system is defined as threat.

To each external threat corresponds weak or critical point inside system that is defined as *vulnerability.*

During risk definition there is direct correlation between probability to occur harmful event and system vulnerability. Testing system vulnerability i.e. threats and probability to occur harmful events represent center of Risk Analysis activity.

[23] Ibidem

[24] NN 103/03 Republic of Croatia

[25] NN 172/03 Republic of Croatia

Consequences to system, caused by threat, depend of course on asset value and consequence analyses for each typology of events represent another important aspect of risk analysis process.

Risks are analyzed by determining harmful event impact according to potential damage value and probability of harmful event occurrence as it is shown on Fig. 2.

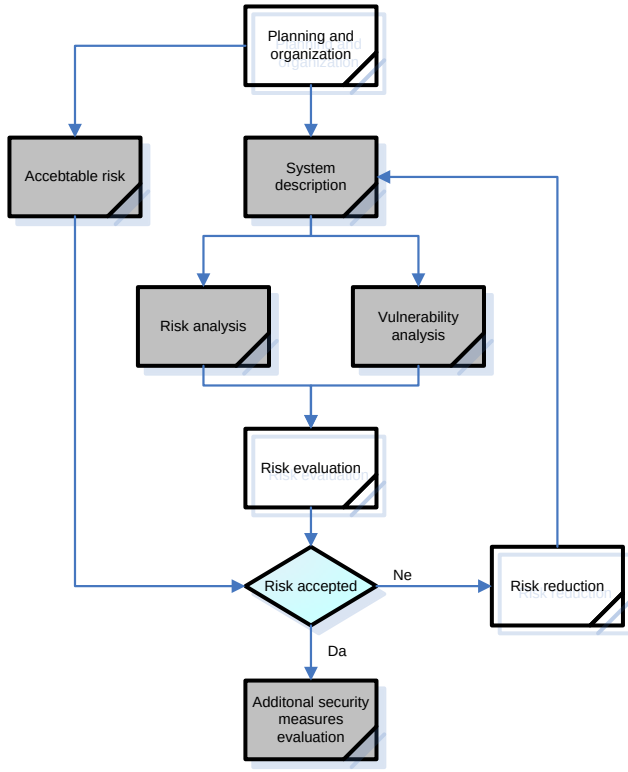

Fig. 2. Process of system risk analysis in eGovernment model

6. RISK ANALYSIS METHODOLOGY – RISK MANAGEMENT IN BUILDING EGOVERNMENT MODEL

It is selected own method of Risk Analysis that utilizes two pre-existing methodologies CRAMM (used by British government) and MAGERIT (used by Spanish government).

6.1. TERMINOLOGY

Used terminology and term definitions are as follows:

asset

private information system resources or resources related to them, required for properly organization functioning in order to achieve goals set by company governance.

endangering

reduction of asset value because of concretization of threat

countermeasures

procedures or technological mechanisms for risk reduction

influence

consequence of concretization of asset threat

threats

events that can cause accident in organization by creating material and immaterial lose (loss of service process continuity, loss to image of organization etc.)

risk

estimation of exposure level to concretization of asset threat in relation to possibility of harmful event

6.2. METHODOLOGICAL APPROACH

Selected method of risk assessment consists of 5 steps that are described to following way.

Step 1: Asset

Crucial asset for company activity is represented with information or data that company disposes of. Starting with them we can identify other important asset typologies:

- Services based on specific or essential data
- Informatics' programs for data analysis
- Informatics' instruments that contain data, applications or services
- Media for data storage
- Auxiliary informatics tool that complete informatics material
- Communication network that allow data interchange
- Structure in which are set informatics and communication resources
- Personnel that uses or controls above mentioned elements

Asset of general character is represented with data or services. In each case, it depends on other asset typologies as informatics tools, communication tools and personnel that uses or controls them. Because of everything that is mentioned, of enormous significance is interaction dependence concept between different asset typologies or measures in which higher rank asset can be endangered by lower rank asset security accident.

Division of asset by rank represents presentation of interaction cause-effect connection and allows calculation of information total risk.

Level of importance can be described as follows:

Level 3:Infrastructure that is necessary for functioning of others levels of importance (electric energy, acclimatization, personnel, and objects)

Level 2: Information, data, company responsibility functions

Level 1: Other asset (company identification, image etc.)

Each type of property requires the following:

- Users or information authenticity
- Privacy
- Integrity
- Availability
- Traceability

The property has to be evaluated. That can be realized by using quality and quantity scales.

The use of quality scale speeds up the activity. It is positioning the property value as relative relation against the rest of property. At the end, the result does not show the absolute value of risk in money. It shows risk valuation considering order of relevance.

Step 2: Threats

In this step we define threats that might compromise all types of property. The threats include natural disasters (flood, earthquake) and problems with electric power that can harm passive information systems. We should consider also the threats from mans behavior that can be malicious or accidental damages. All types of threats do not consider all types of property, but there is a certain relation between types.

When we determine what threat can affect the certain property, we also determine the level of sensitivity for each type of property. We use the following parameters:

- **endanger**: what is the result of endangered property (per cent)
- **frequency:** how often we verify the threat (in one year)

TABLE I.
PRESENTANTION OF ENADAGEMENT AND FREQUENCY OF THREAT VERIFICATION

frequency	*definition*
100	Very often
10	Often
1	Normal
1/10	Rarely

Step 3: Countermeasures

The risks and influences on company's property must be considered as the property is not protected. Some threats can be eliminated by better process organizing and some require technical solutions, protection and Human resources management.

The countermeasures are used for risk analysis in 2 ways:

1) By reducing threats frequency,

These are so called preventive countermeasures.

2) By limiting volume of damage

These are so called corrective countermeasures. They prevent the systems endanger, so the consequences are limited.

Step 4: The definition of impact on property

If we know the value or importance of property and the level of systems endanger, it is possible to analyze the impact of incidence on system.

It is often that systems value is concentrated on data or services, that it is offering, while threats are pointed to the medias that contain data.

There are 2 types of impact analysis:

a. Cumulative impact

It is analyzed considering the cumulative value of property (own value and related value) and the threats that is exposed to.

b. Reflected impact

It is analyzed considering the estimated value of property considering and the threats considered by the values of the asset that is exposed to.

Both impacts are analyzed for each type of property, for each level and level of importance.

Single impacts can be combined in several ways:

- By uniting of reflected impact on different types of property
- By uniting of cumulative impact on different types of property, considering independent types
- By uniting the influences of different threats on one type of property
- By uniting the influence of one threat at different levels of importance.

Step 5: Determination of risk

There are 2 ways to evaluate the risk:

a. Cumulative risk

It is valuated for property considering the cumulative impact that is connected to threat and its frequency.

Cumulative risk insures the determination of countermeasures that are related to protection of working environment (safe copy of data, computer protection).

b. Reflective risk

It is analyzed for each property considering the reflective impact, which is connected with threat and its frequency.

Reflective risk that is calculated for property that has its own value, insures the determination of consequences related to technical incidents that affect Information security system.

This parameter is very important for management decisions in order to accept the certain level of risk.

Single influences can be combined in different ways:

- By uniting of reflected impact on different types of property
- By uniting of cumulative impact on different types of property, considering independent types
- By uniting the influences of different threats on one type of property
- By uniting the influence of one threat at different levels of importance.

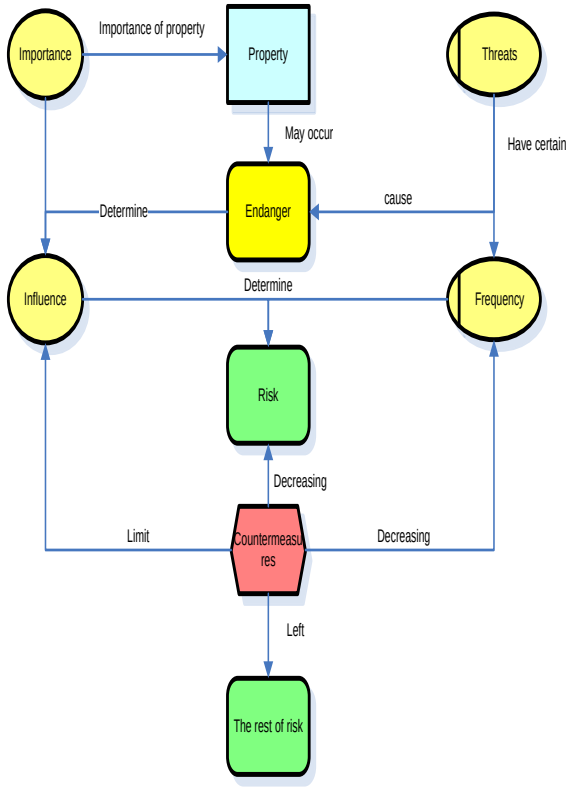

Fig. 3. The risk evaluation methodology

6.3. THE CHRITERIA OF RISK EVALUATION:

The chosen method can use the scale from 1-9 by evaluating risk.

TABLE II.
THE RISK DESCRIPTON AND IT'S EVALATION

Risk		Description
9	Very high	The possibility of serious damage for company
7-9	High	The possibility of consistent damage for process of services or for single organization function.
4-6	Middle	The possibility of damage for process of services or for single organization function.
2-3	Low	The possibility of minimal damage for process of services or for single organization function.
1	Minor	Irrelevant damage for process of services or for single organization function.

7. CONCLUSION

Best practices encompass technological, organizational and training components. They require a long-term commitment on the part of all key players involved. Exchanges of experience and replication of best practices can bring significant cost-savings in moving to broad take-up. They also prepare the ground for future interoperability and networking between administrations.

A range of European Community initiatives and programmes are addressing eGovernment. In particular, they are reinforcing exchanges of good practice. They include parts of the Sixth Framework RTD Programme, the eTEN and IDA programmes and investment in regional priorities through the Structural Funds. The Commission reports that investment is low compared to the total investment that should be made at European Union level.

Annual spending on ICT in public administration is about 30 billion, of which a growing proportion, currently some 5 billion, is related to eGovernment. The Commission adds that this spending should be accompanied by much larger investment in organization and human resources. As a result, the total investment needed is likely to run into tens of billions of euros each year. Community support should therefore aim at achieving maximum leverage for the much larger investment at Member State level, in state which Croatia is acquiring to become.

The next step forward should be the establishment of a postgraduate specialized study in eGovernment, based on examples of the best EU practices, to provide knowledge for a successful eGovernment projects delivery and eGovernment systems management.

Also, at this stage the cooperation with other countries to have arisen from disintegration of the post-communist Yugoslavia is vital and I have proven of this by invitation of guest lecturer

at this eminent conference IS DOS 2010 and by hearing of both - provided examples of best practices in solving state administration problems and ensuring technological interoperability essential for establishing a quality relationship with future EU member countries.

In order to follow their steps it's necessary to use all of the potentials, engaging the legal and security aspects (including in international standards) to bring the solving questions of citizens privacy and security of personal data at the highest level.

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Open Standards and Open Source Code in eGovernment*

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Abstract: **This paper presents a brief overview of an approach to open standards and open source code and free software solutions in eGovernment. Also, two case studies implemented by the authors of the paper are presented. The first one shows the example of open standards and open source software application to communication infrastructure, while the second one shows application of open standards and open source tools to knowledge management in eAdministration.**

1. INTRODUCTION

Among others, the following two basic elements are currently recognized as fundamentals of sustainable human society development:

- Knowledge as a key resource of the whole economic but also cultural and any other development of the human society, and
- Information and Communication technologies as technological means aimed at assisting development of all segments of human society.

One extremely important segment of the modern society with its complex structure and diverse communities is eGovernment. Implementation of the complex eServices for eGovernment calls for software solutions suitable for interoperability among diverse software and hardware platforms.

Interoperability as a key factor for successful eGovernment has been recognized in European Union (EU) countries [1, 2, 3, 4, 11, 12, 13, 14, 15, 16] and other developed countries in late 90ties.

The interoperability problem can't be resolved without open standards. Therefore, the open standards principle is a *conditio sine qua non* for eGovernment.

Additional requirements that are not mandatory but, for sure, are desirable for eGovernment software solutions are vendor-independence and cost reduction. Open source code and free software solutions offer an alternative satisfying these requirements up to certain extent.

Finally, experiences and examples related to implementation of both open standards and open source/free software solutions are useful for broader audience.

Therefore, the rest of the paper is organized in four sections.

Section 2 presents a brief overview of interoperability frameworks, open standards relevant for eGovernment and how USA and EU countries are approaching open standards within an eGovernment context.

Section 3 presents utilization of open source solutions in eGovernment.

Section 4 presents two case studies illustrating possible applications of open standards and open source in eGovernment solutions in Serbia.

Finally, Section 5 brings concluding remarks and further research directions.

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2. INTEROPERABILITY FRAMEWORKS AND OPEN STANDARDS IN EGOVERNMENT

In [11, 16] Luis Guijarro presented the main initiatives in the area of eGovernment and interoperability frameworks (IF) development in USA, UK, Germany, France and EU. The main documents dealing with legal/technical interoperability issues in USA, UK, Germany and France are listed in Table 1.

Significant documents related to interoperability issues in EU are *The IDA II Decision 1720/1999/EC* "Interoperability and access to TEN for IDA" published in 1999, and the document "European Interoperability Framework for Pan-European eGovernment Services version 1.0" (EIF 1.0) published in November 2004. The document "European Interoperability Framework for Pan-European eGovernment Services version 2.0" (EIF 2.0), which is successor of EIF 1.0, was adopted by the European Commission as the *Annex II - EIF (European Interoperability Framework)* of the *Communication "Towards interoperability for European public services"* on the 16th of December 2010.

Table 1: The main documents related to interoperability issues in USA, UK, Germany and France

Document title	Country	Publication Year
"Information Management Technology Act" (Clinger-Cohen Act)	USA	1996
FEAF "Federal Enterprise Architecture Framework" Version 1.1	USA	2002
FEA Consolidated Reference Model Document Version 2.3	USA	2007
"e-Government. A strategic framework for public services in the Information Age"	Great Britain	2000
E-GIF e-Government Interoperability Framework Version 6.1	Great Britain	2005
Bundonline2005	Germany	2000
SAGA Standards und Architekturen für E-Government-Anwendungen Version 1.1	Germany	2003
SAGA Standards und Architekturen für E-Government-Anwendungen Version 2.1	Germany	2005
"Pour une administration électronique citoyenne"	France	2001
CCI Cadre commun d'interopérabilité v.1	France	2001
CCI Cadre commun d'interopérabilité v.2	France	2003

The issues of open standards in eGovernment are the subject of significant and comprehensive attention for the last two decades.

In the source [7] the Italian open source advocacy group *Associazione per il Software Libero* states:" Using open standards and open source is the best option for Italy's plans to modernize government, improve education and cut costs."

The source [8] says: "EU governments should use open standards and interoperable systems to deliver electronic government services, EU ministers and the European Commission agreed earlier this week. They also stated they would promote the reuse of public sector information."

In the paper [5], which is aimed to outline how the balance between standardization and intellectual property is struck by respecting the principles of transparency and non-discrimination, the author exposes: "To preserve consistency with EU policy and legal positions taken, in particular with regard to European and international IPR and public procurement law, it is important that EU Member States governments and European institutions, including the IDABC unit of the European Commission which does not speak for the European Commission as a whole, defend, amongst others, strong principles of technological neutrality, non-discrimination and equal treatment". The focus of the paper is actually on the two main stakeholders with different and often opposite interests considering open standards: (1) Governments and Governmental bodies, and (2) ICT companies. The position expressed in the paper is that standards should be related to technical interoperability and the conclusion is as follows:

- Open standard, as a set of rules and specifications describing operative characteristics of programs and/ore devices, should be published and publically available to technical community.
- Open standards should be created in open procedure/process.
- Conformance to open standards should be the main criteria when selecting the software solutions for eGovernment.

It is worth to mention that the document EIF 2.0 was severely criticized by the free software community (Karsten Gerloff and Hugo Roy, Free Software Foundation Europe) in [17]: "Based on the above analysis, we can only conclude that the European Commission is giving strong preference to the viewpoint of a single lobby group. Regarding interoperability and open standards, key places of the consultation document were modified to comply with the demands of the BSA[1]. Input given by other groups was not considered on this issue. Beyond ignoring this input, the Commission has apparently decided to ignore the success of the first version of the EIF, and to abandon its efforts towards actually achieving interoperability in eGovernment services. "

Already mentioned sources [11, 16] give an overview of criteria for selecting the standards to be included into interoperability frameworks. Table 2 shows the selection criteria for FEAF, e-GIF 6.0, SAGA, CCI and EIF 1.0.

The same author in [16] states that:

- IETF, W3C and OASIS are recognized as reference standardization bodies by eGovernment agencies.

[1] Business Software Alliance

- Regarding the document format standards (present in e-GIF, CCI, SAGA and AG), the open standards as well as proprietary standards (PDF – Adobe and RTF - Microsoft.) are accepted.
- Regarding application platforms (present in SAGA, AG and EAG) J2EE is always recognized as an option, while some interoperability frameworks do not assign the same level of recognition to .NET platform.

Table 2. Standards selection criteria

Interoperability Framework	Criteria
USA (FEAF)	Voluntary consensus standards
Great Britain (e-GIF 6.0)	Interoperability, market support, scalability, openness, international standards
Germany (SAGA)	Interoperability, reusability, openness, cost and risk reduction, scalability
France (CCI)	Interoperability, mutualisation
EU (EIF 1.0)	Qualified as "open standard"

The paper [9], among others, brings an analysis of what standardization is demanded for interoperability of e-Government agencies and how different countries' governments are prepared to ensure such interoperability in public administration in the light of documents, institutional norms and open standards. The following interoperability frameworks have been analyzed: Federal Enterprise Architecture (USA), The e-PING architecture (Brazilian standards for interoperability), New Zealand e-Government Interoperability Framework, Australian Governmental Interoperability Framework, Hong Kong Interoperability Framework, India e-Governance Framework, Malaysian Government Interoperability Framework, Yesser Framework for Interoperability (Kingdom of Saudi Arabia), United Kingdom e-Government Interoperability Framework, German Standards and Architectures for Interoperability, Danish e-Government Interoperability Framework, Estonian Interoperability Framework, and European Interoperability Framework.

The conclusions are as follows: (1) "There is a common understanding among European public administrations that electronic document exchanges and storage should rely on open document format. Such formats are to be defined in a process open to all interested parties and to be available for all interested and competent actors to implement without restrictions."; (2) "Well elaborated in different countries, interoperability frameworks consider mostly semantic, technical and organizational interoperability, focusing on open standards and open source software development. They receive quite good results in the development and implementation of open standards, however the administrative processes standardization is the most difficult effort and it demands further research."; (3) "Taking into account presented above survey on different national frameworks for interoperability, it should be noticed that interoperability in e-Government institutions follows citizens' needs and their motilities. Therefore, interoperability models and practical solutions ought to be developed across national borders, across corporate boundaries, and across educational systems."; (4) "So far, there is lack of coherent overall programme, specification of such requirements and competing expert organizations. The desirable future outlook for e-Government should cover new design methodologies and construction processes founded on interoperability frameworks."

Along with documents discussing open standards and interoperability at general level, there are a large number of the papers related to specific implementations of standards and interoperability. Only two characteristic examples will be mentioned here.

The source [10] presents a solution to web services for eGovernment in Germany emphasizing the web services security issues and standardization at the application level. *OSCI Transport Version 1.2* is adopted as the basis for secure web services and *OSCI XMeld* (*XML für das Meldewesen*) which is an open standard, designed for civil registration in Germany, as application level standard.

The paper [11] presents the proposal for government interoperability framework based on an existing architectural framework Archimate (which is expected to become an international standard) as a reference for developing electronic interfaces.

The proposed framework semantically specifies information requirements as the basis for electronic interfaces supported by open standards. By mapping government concepts to Archimate concepts, the authors have developed high level government semantics and the high level application services for eGovernment which are detached form implementation technology. The standards and technology for government service description and discovery could be, for instance, WSMO and OWL-S. Application services are generic and could be structured with a WSDL. The concepts of government semantics could be represented by an XML Schema or other technologies like OWL or RDF Schema. For query-response type of application services XQuery or SparQL are suggested as currently suitable technologies.

It is necessary to mention that cloud computing paradigm and its relation to open standards is the subject of significant attention in latest publications

3. OPEN SOURCE CODE AND FREE SOFTWARE IN EGOVERNMENT

The hallmark of open source software development is, as the name suggests, unrestricted access to software source code. Focusing on source code access alone, however, is an oversimplification: various software systems have historically been supplied with parts, or even the whole, available in source form, without being “open” in modern sense. A more salient characteristic would be the scope of users' rights with regard to modification, utilization and distribution of modified software, along with the size of the user base to which the rights and limitations apply. Since there are multiple variables involved, with each capable of having multiple values, it should be evident that openness of a software system is not a binary proposition, but a continuum, starting with wholly proprietary systems at one end, passing through limited access schemes backed by nondisclosure agreements or similar restrictions, and ending with various “copyleft,” permissive licenses, and finally public domain software at the other extreme. Open source is not a synonym for open standard since the fact that some software is open source does not necessarily mean that it complies with open standards.
This section of the paper explores open source code in eGovernment from two points: utilization of open source code solutions in eGovernment, and general attitude of the governance/administration to open source code solutions in eGovernment [19, 20, 21].
The utilization of open source code in eGovernment is illustrated in this paper through two projects from the FP6 programme: Project FLOSSPOLS - Free/Libre/Open Source Software: Policy Support [20] and Project COSPA - Consortium for Open Source Software in Public

Administration [21] as well as the project *An Alternative for eGovernment Based on Open Standards and Open Code* [22] financed by the Ministry of Science and Technological Development of Republic of Serbia during the period March 2008 – December 2010.

The **FLOSS** project was aimed at collecting data about the usage and development of OS software in Europe. Surveys were conducted between February and May 2002 on about 1.500 companies and public institutions, asking whether they were employing, or willing to employ, OS software. Four hundred of these were indeed using some kind of OS software, or planning to do so in the near future. There are two important findings of the FLOSS study for this paper: one about the use of desktop applications vs. use of OS server and IT infrastructure solution, and another about abilities of the public institutions to quantify the benefits of using Open Source software (OSS) applications. OSS for desktop applications was employed only by the 20% of the establishments using OS software, and only by 10% of them the OpenOffice was used, which conforms to common wisdom that OSS is better suited for server and IT infrastructure tasks. The findings also show that companies and public institutions were generally unable to quantify the benefits deriving from the use of OSS applications, even the obvious ones like license fees' savings and hardware cost savings.

The **COSPA** project was aimed exactly at analyzing the effects of the introduction of Open Data Standards (ODS) and Open Source software (OSS) for personal productivity and document management in European Public Administrations (PAs).

The Project is consisted of 8 Work packages (WPs), of which the WP 2 is particularly interesting for this paper since it covers the following: Catalogue of available Open Source tools for the PA; Analysis of Requirements for OS/ODS Applications in the Public Administration; Framework for evaluating returns/losses of the transition to ODS/OS (including the key criteria for evaluating the effectiveness of the transition to OS/ODS); Prioritization of requirements for OS and ODS

The Catalogue of available Open Source tools for the PA was created based on data collected from Project partners. An email questionnaire, containing 181 OS solution classified into following categories, was used:

1. **Administrative Workflow and Workload management (**Text processor and publishing tool, Translation tools, Spreadsheet, Personal and project assistant, Development tools and libraries)
2. **Communication and management of public sector documents (**Hypermedia, Network communications, Graphics)
3. **Database (**Front-end and clients, Knowledge management)
4. **CAD/CAM and Geographic Information Systems**
5. **Security, encryption, PKI and authentication – electronic (**Firewall & tools, Digital signature)

Partners in the Project (7 institutions) and 18 "observer" institutions had to indicate whether they were currently using or they were planning to use these tools ("**U**" if the software was in use; users were also asked to add also the version in use and

when it was first adopted; "**P**" if the user planned to use the software, but it was not yet installed; "**D**" if the user had disposed the tool after using it; users were also asked the last version of the software used, when it was first adopted and when it was disposed; "**X**" if the software was never used.).

The results of the survey had shown that **the acceptance of OSS solutions in public administration is extremely low**. At partners' institutions 90.69% of the software tools have never been used, neither they plan to use any of them; 0.16% of the OSS solutions have been used, but now they are abandoned, 3.39% were not used but there are plans for their future use and only 5.76% is actively used. The "top-ten" actively used OSS applications in partners' institutions were: Open Office, Gnome, KDE, MySQL, MaxDB, Vnc, GIMP, Evolution, Eclipse and MySQL Control Center. The "top-ten" OSS applications planned for future use in partners' institutions were: Firefox, GIMP, MySQL, KDE, Gnome, Clam Antivirus, Nagios, Thunderbird, Dosemu and Kopete

At "observers'"' institutions 93.68% of the software tools have never been used, neither they plan to use any of them; 0.28% of the OSS solutions have been used, but now they are abandoned, 1.81% were not used but there are plans for their future use and only 4.14% is actively used. The "top-ten" actively used OSS applications were: Open Office, KDE, Gimp, MySQL, Vnc, PostgreSQL, Wine, Firefox, Gnome and Thunderbird. The "top-ten" OSS applications planned for future use were: GRASS, Amanda, Gnumeric, Firefox, Gimp, Opensign, Opensignature, Partition Image, MySQL Control Center and Gnome.

The catalogue, which is created for the Project, contains the tools available, organized according to the adopted categorization. For each tool, there are seven entries, intended to provide interested readers with all the details needed to understand whether the tool could be of relevance for them, to determine whether to install the tool, and then, to gather information to become operational on the tool. The entries are:

1. Purpose of the tool
2. Current development status
3. The platforms on which it works
4. Intended audience categorized as *Users* **(**Developers, Administrators, Software Integrators, Expert Users, and End Users) or *Administration* **(**Municipal authorities, Provincial administration, and Central government)
5. Location for download
6. Requirements for training people using the tools
7. Requirements to install and maintain the tool
8. Available documentation

The research conducted within the project *An Alternative for eGovernment Based on Open Standards and Open Code* [21] comprises, among others, the state and trends of provincial and local (municipality) public administrations' OSS utilization in of Autonomous Province Vojvodina.

The state and trend for province administration are estimated based on two main information/data sources: (1) the official policy documents that equally treat OSS and vendor solutions for provincial administration, and (2) results of the software related public procurements in last five years. The findings indicate that there is tendency to OSS solutions in provincial administration, but there are also significant declinations from the declared policy when it comes to decide for the specific procurement. The research that could identify and scientifically confirmed the reasons for such behavior has not been conducted, but there are

some clues that lack of adequate documentation for OSS and professional capacities of IT staff in provincial administration could be the basic causes for such situation.

For investigating the situation in local public administration, a survey technique was used. The aim was to collect relevant information about IT departments and services considering human and technical resources as well as to determine availability, dispersion and acceptance of OSS in local public administration.

The Questionnaire on State and Application of ICT in Local Governments of APV that contains 19 items (with subitems) organized in four groups (ICT department Resources and Organization; System software; Applications; Use of Internet) was sent to all local governments in APV (45 in total) on December 1st 2008. As of December 31st 2008, which was the deadline for returning the forms, 33 out of 45 returned their answers.

The findings for work stations' operating systems show that the Windows family is the most frequently used (2625 work stations, i.e. 99%) with dominating Windows XP (92%). The total number of work stations running Linux was 31 (1%) with dominating Ubuntu (52% of stations running Linux)

Regarding the servers' operating system the situation is slightly different: 85 (77%) machines were running Windows family operating system, 20 computers (18%) were running Linux family, while 5% were running some other operating system.

The most frequently used DBMSs were: Microsoft SQL Server, MySQL, Oracle and PostgreSQL. The share of proprietary software (MsSQL and Oracle) was 64%, while license-free solutions' (MySQL and PostgreSQL) share was 36%.

Out of 15 installed Web servers in total, 7 were running Microsoft IIS, while 8 were running Apache.

The Microsoft Office was most frequently used for office applications (29 out of 33), but the Open Office was also significantly present (16 out of 33).

Extremely poor utilization of document management systems in local administration was indicative; OSS DMSs were not used at all.

The findings show significant share of the Mozilla Firefox (21 out of 33). For maintaining the official presentations the CMSs Joomla (4 out of 33) and Apache Lenya (1 out of 33) were used.

Solutions aimed at IT configuration management were not applied in any of local administration.

When speaking about OSSs and their applications in governmental institutions, one can not avoid discussion about the general, political attitude of the governmental institutions towards this issue. At this very moment this is an extremely "hot" topic due to the fact that government is set into position to balance between two opposite goals: the first that strives to exploit potentials of open approach in the domains of interoperability, transparency and cost reduction for governance/administrative operations; the second which is imposed by the role of government in economy management and the attitude advocated by some "big players" in software industry who are endeavoring to preserve or even improve their market positions. There are numerous examples of public administrations shifting towards OSS (Germany, France, Norway and, recently, Russia) [23, 24, 25,], but the standpoints like those presented in [6] that contest the legal basis for preferential treatment of the OSSs in public procurements must also be taken into account. One good example is the EIF 2.0, latest version of EIF.

4. CASE STUDIES

In this section two case studies aimed at illustrating application of open standards and OSS in selected domains of eGovernment are presented. The first case study is dealing with application of open source code solutions to communication infrastructure, while the second one is application to public administration's knowledge management.

4.1. Case study: Communication Infrastructure

The case study related to communication infrastructure is presented in details in [28]. Representative examples of open source projects related to communication infrastructure are considered with emphasis on their provenance, history of development and environmental forces which may have affected the project's success and present status [29].

In the first part the analysis of networking projects was conducted on TCP wrappers project, Quagga project, Squid project, Sendmail project and Asterisk project. Some of them, like Quagga and TCP wrappers, although having the potential of widespread third-party use, had slowed down or even ended its active development.

If the success of those two projects might seem questionable, there is little doubt about **Squid**. This proxy caching package is long-lived, actively developed, and in widespread use. Despite fulfilling the criteria for a typical network layer service, the foremost, form users' perspective, being invisibility aside from initial configuration, and despite the existence of proxy caching appliances, Squid appears in no danger of being supplanted. One reason may lay in the extreme flexibility of Squid's configuration, allowing it to be adapted to a wide variety of site policies.

There are also abundant examples of long-lived communications software projects. Perhaps the oldest major communications project still in active development, **Sendmail** was first written alongside the Berkeley Unix release 4.1c, which introduced TCP/IP networking on that system. Sendmail was a dominant Internet mail transfer agent for all of its life, although its lead is currently not as overwhelming as in the past. Its security record, especially in the era of rapid Internet growth, was not exemplary: there was a period when new vulnerabilities were being discovered almost monthly. (This actually sparked the development of alternative MTAs such as **qmail** and **Postfix**, also open source projects.) Nonetheless, the large installed base, administrator familiarity and proven flexibility helped it maintain its leading position.

A more recent communications project of note is **Asterisk**, a software PBX which combines the ability of access to public telephone network with robust support of Voice over IP (VoIP) technologies. As VoIP usage has raised in all voice communications market segments, so have the requirements of end users and administrators. Asterisk's open source license encouraged numerous contributors to enhance the software's functionality. One notable characteristic of this project is its use of ITUT standards ("recommendations") like H.323, historically available only to national standards bodies for a substantial fee. Doubtlessly recognizing the success of the Internet standardization model, ITUT has started making a number of its standards freely available, including the ones pertaining to telephony.

The same source [28] presents an example of OSS network monitoring applications for two core system aspects, one intrinsic and the other involving a communications subsystem: alert prioritization and error reporting. The implementation is based on two OSS solutions: **Nagios** and **Kannel**.

The **Nagios** [30] network monitoring system is an open source project which is widely used and very actively developed. Architecturally, it can be thought of as an event scheduling engine, with events being either regularly timed device or service health probes, or alert generation in response to probe results. The core engine is augmented with a plug-in system which handles actual probe functionality, and is extensible by the users, giving the system much of its flexibility. Device and service probe configuration allows the definition of a hierarchy, assisting the proper alert prioritization.

Nagios setup which is the subject of this case study is a regional academic network node at the University of Novi Sad. The network is both a transit hub for both national and international links, and a campus network hub, the aggregation point for local area and metropolitan branch networks connecting the academic institutions. Its topology is basic hubandspoke hierarchy, complicated by some redundant links for enhanced resilience. The topology could be adequately defined using standard Nagios configuration facilities. Service definition was also straightforward, although a custom probe had to be developed for the network's dialin service.

Error reporting in a network monitoring application requires careful design in order to be effective. Redundant options must be considered in order to achieve highly reliable report delivery; a communications channel independent of the monitored network is a good alternative in case of catastrophic primary network failure. Reporting must be closely coupled to alert prioritization, with some kind of priority level cutoff to avoid inundating the reporting channel with dependency failure messages. For the UNS network, email and SMS reporting channels were configured, with the latter delivering only emergency alerts during outofoffice hours.

Using SMS delivery means that there has to be an SMS gateway in the network. Using an external SMS provider with TCP/IP gateway delivery is contrary to the goal of independence from the primary network, so a GSM modem directly attached to the Nagios server was a preferred solution. In this kind of setup, a driver application is still needed to deliver messages, and for that purpose an open source package named **Kannel** [31] was chosen.
Kannel is an SMS and WAP gateway. Its SMS handling capabilities include acting as an SMS center (SMSC) with support for a number of open and proprietary SMSC protocols. There is also support for using a GSM modem (or any mobile handset with modem functionality) as a virtual SMSC, which was ideally suited to our setup. Kannel's WAP gateway functionality was used to test the WAP/WML interface for Nagios, which is a simplified version of its regular web interface, meant for quick troubleshooting. An experimental custom Nagios SMS message generator was developed, which transformed an alert to an SMS service message, which would allow the recipient to initiate a WAP session from the mobile handset immediately upon receipt, with the encoded URL directly pointing to the source of alert. This generator has not been put into production, since the treatment of service messages by various handsets is quite unpredictable, not being standardized in any way.

4.2. Case study: Knowledge Management in Public Administration

Knowledge is the basic driver and resource when management and business are considered. Therefore, one of the basic aims of eGovernment is to provide mechanisms for acquisition, storage and utilization of diverse knowledge.

Common part of each administrative procedure is documenting all decisions that have been made. For decision making, but also for creating such documents, the deep knowledge of relatively large amount of general and specific legislative and other legal documents is required. This case study presents the system aimed at assisting young, inexperienced civil servants in decision making and creating the corresponding documents through guided access to the knowledge needed for decision making and document templates which is implemented in [32].

Figure 1. depicts the architecture of the system. The central part of the system is the knowledge portal of the public administration ontology. Public administration ontology is a knowledge repository containing the knowledge about administrative procedures, entities participating these procedures and documents that are interchanged. Knowledge engineer, in cooperation with administrative expert, updates the public administration ontology.

Administrative procedures' search engine enables the civil servant to search available procedures, inspect their structure and workflow and to gather information on procedures comprising involved entities, necessary documents, laws and other legislative documents regulating the procedure and other information that can be useful to civil servant in understanding administrative procedure.

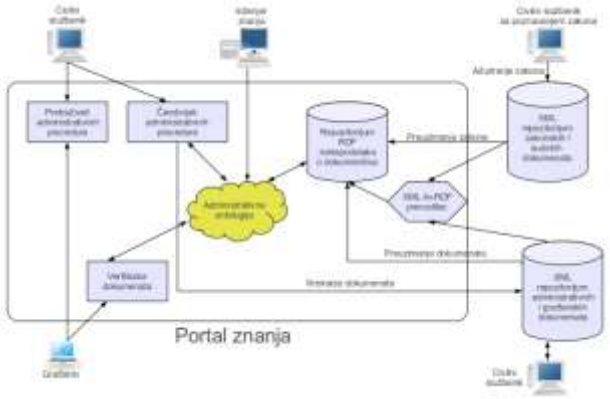


Figure 1. System architecture

The administrative procedure's wizard guides civil servant through the procedure flow step-by-step, thus helping him/her in generation of the documents that are used in given procedure. Document generation relies on document templates which are the part of administration ontology. The wizard also enables insight into flow of the initiated procedure.

RDF repository of meta data contains the meta data of laws, judicial and other legislative documents as well as meta data of the documents being created by the administrative procedure and the data on running administrative procedures.

The legislative documents are stored in an external repository in Metalex format.

All persistent documents created during the execution of the administrative procedure are stored in external repositories in XML format, so they can be used as help for decision making.

The central part of the portal is the public administration ontology [33] consisting of three parts: ontology of the public administration structure, ontology of public administration's documents, and ontology of public administration's services.

Ontologies of the Public Administration Structure and Public Administration Documents

Ontologies of the Public Administration Structure and Public Administration Documents are represented by the Web Ontology Language (OWL) which is W3C recommendation.

Figure 2 shows the Ontology of the Public Administration Structure which distinguishes four types of entities: Administrative, Legislative, Judicial and Citizen [33].

Figure 2. Ontology of the Public Administration Structure

Figure 3. depicts the document aspect of the public administration ontology. The ontology recognizes four basic document types: Administrative, Legal, Judicial and Citizen. Documents that are of Administrative type are products of administrative procedures.

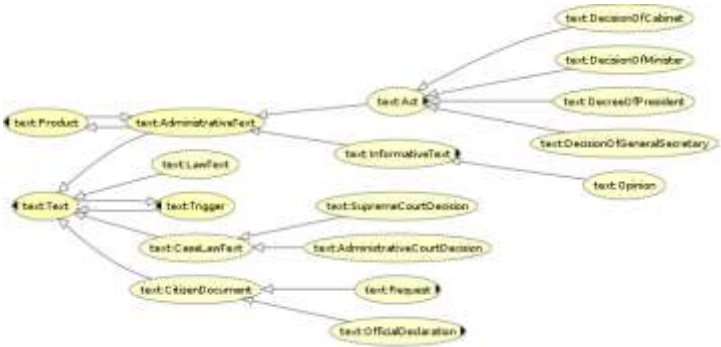


Figure 3. Ontology of the Public Administration Documents

Administrative documents can further be classified as legal acts that directly affect the real world, and the informative texts having no influence on real world. Each document can be trigger for the administrative procedure or some of its part which means that generation of this document further leads to activation and execution of the procedure.

Ontology of the Public Administration Services

Public administration service ontology is created as an extension of the OWL-S ontology. OWL-S is the ontology that is used for semantic web services description and is also an open standard. Figure 4. shows the ontology of public administration services as an extension of OWL-S ontology.

OWL-S ontology has three basic parts: service profile offering service description, process model describing the how the client interacts with service and service grounding that provides details for that communication.

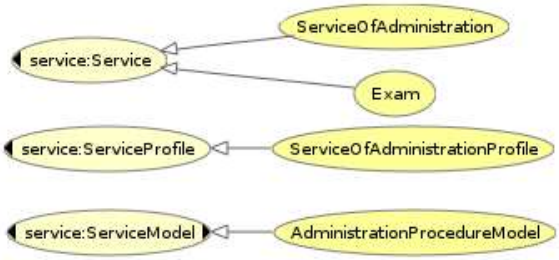


Figure 4. Public administration services ontology

Figure 5. presents the ontology of Public administration procedures.

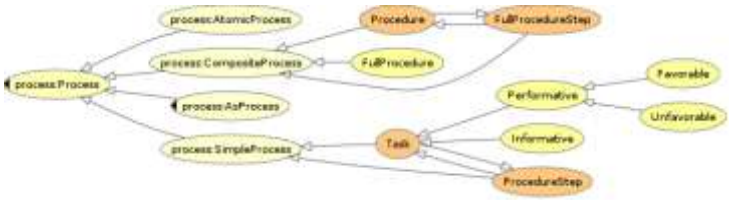


Figure 5. Ontology of the Public administration procedures

The basic concepts of this ontology are full procedure (FullProcedure), procedure (Procedure) and task (Task). The full procedures are consisted of one or more tasks. The tasks are atomic and they can not be further decomposed. Any document can be an input to the task, while each task produces an administrative text.

Since each task has a document as an input and/or output, the whole flow of the full procedure is actually controlled by documents' creation and exchange.

All full procedures, procedures and tasks also have references pointing to legislative documents and documents' parts that are regulating them. This provides civil servants an easy access to the text of corresponding legal document.

The Service for Civil Professional Exam

The ontology which is presented in previous subsections was used for implementation of electronic service for civil professional exam by extension containing several specialized classes.

Figure 6. depicts the classes of the ontology that model service itself as well as service profile.

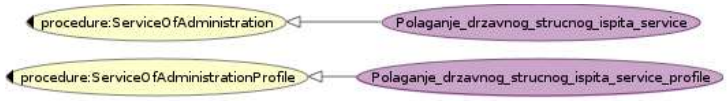


Figure 6. The classes modeling service and service profile

Here, the predicate *process:hasProcess* connects the class *Polaganje_drzavnog strucnog_ispita_service* with full procedure that describes the service structure.

Polaganje_drzavnog_strucnog_ispita_full_procedure is the class that describes the procedure of civil exam as depicted by Figure 7. During the execution of the civil exam procedure, the instances of presented classes are created which provides possibility to track flow of each single procedure.

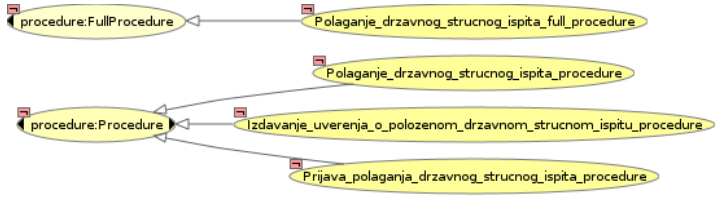


Figure 7. The structure of the implemented service's procedure

Figure 8. shows the process models of the implemented service. The process models allow connecting the full procedure (and procedure) with its parts using the restriction *process:composedOf.*

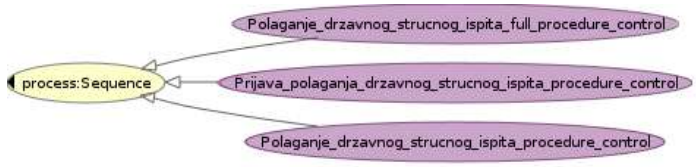


Figure 8. Processes' models of the implemented service

In Figure 9. the documents that are used within civil exam service are shown.

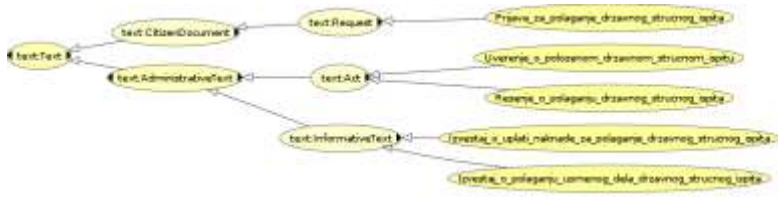


Figure 9. Documents that are used within civil exam service

As already mentioned, for storing legislative documents the external repository is used which stores documents in Metalex/CEN format which is open standard for legal documents exchange in EU. Listing 1. shows the fragment of the document *Bylaw on Programme and Examination Procedure for Civil Professional Exam* in Metalex format.

```
<?xml version="1.0" encoding="UTF-8"?>

<Regulation xmlns="http://www.metalex.nl/latest"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.metalex.nl/latest metalex.xsd">

<Introduction><TextVersion><Title>

Uredba o programu i načinu polaganja državnog stručnog ispita

</Title></TextVersion></Introduction>

...

<Article>

<IndexDesignation>

<Category>Član</Category>

<Index>1</Index>

</IndexDesignation>

<Sentence> <p>Ovom uredbom uređuje se program i način polaganja državnog
stručnog ispita za rad u ministarstvima, organima uprave u sastavu
ministarstava, posebnim organizacijama, sudovima, javnim tužilaštvima,
Republičkom javnom pravobranilaštvu, službama Narodne skupštine, predsednika
Republike, Vlade, Ustavnog suda, službama organa čije članove bira Narodna
skupština, kao i stručnim službama upravnih okruga.</p> </Sentence>

</Article>

...

</Regulation>
```

Listing 1. A fragment from the document *Bylaw on Programme and Examination Procedure for Civil Professional Exam* in Metalex format

The meta data are [illegible] RDF translator, thus providing connection [illegible] ntaining legal acts (documents).

Along with an UI [illegible] ument, each legal document has meta dat

Figure 10. The meta data of the legal document

Use of the RDF meta data repository and query language SPARQL provides for various searches of legal documents.

Software implementation

Software implementation of the proposed service model is based on open standards and open source code tools.

Standards that are used for building ontology are open standards of World Wide Web Consortium (W3C). For ontology modeling the tool Protégé which is OSS was used.

The knowledge portal is implemented as a server application based on REST principles. The application provides classical web application user interface. The server is implemented following the MVC pattern as depicted in Figure 11.

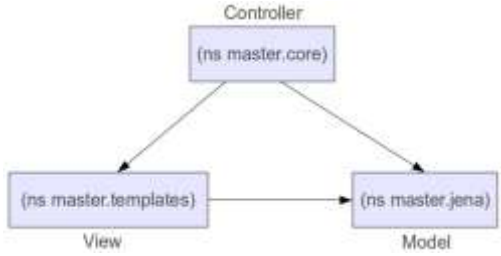


Figure 11. Server implementation based on MVC pattern

The *Jena* framework was used for building semantic web based application. The server implementation is written in programming language *Clojure*, LISP dialect that runs on JVM platform. Along with *Clojure* language, several applications for web applications development are used: *Compojure*, *Enlive*, *Hiccup* and *Sandbar*.

An Example of Service Use

Figure 12. shows the service's web interface. On the top of the page there is the title followed by the line containing controls for starting new service's procedure, lists of the ongoing and finished procedures. On the right side there is a menu, and the description of the service is presented in the bottom-left window.

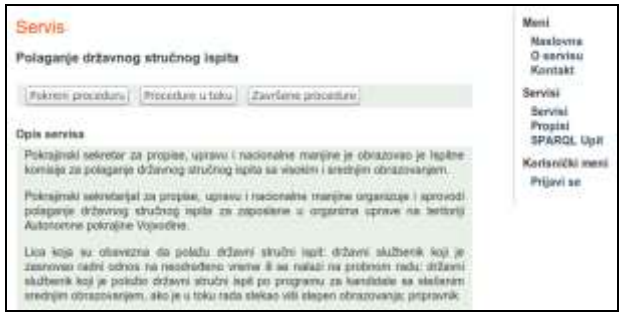


Figure 12. Description of the selected service

In addition to text, the description contains the title of the administrative entity providing the service, list of the legal acts regulating the service with links to legal acts' texts, list of contact persons, list of exams (if the service is of the exam type), necessary documents for starting the service and service structure. An example of the service structure is presented in Figure 13.

For the running service the record of the service flow is kept. The wizard that presents/guides the service flow is shown in Figure 14. The tasks that are finished have a link pointing to task description, while the task that is next in the flow can be scheduled for execution.

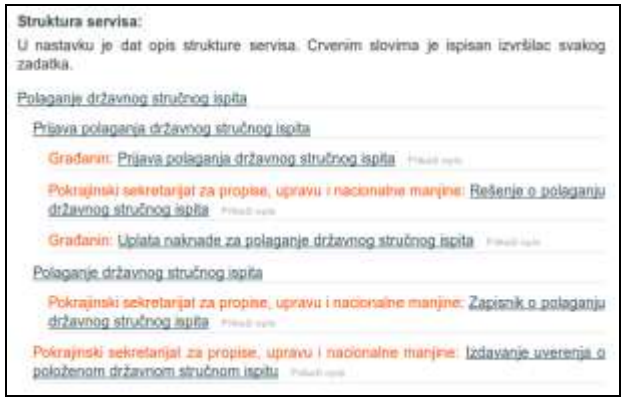


Figure 13. The service's structure

Figure 14. The wizard guiding/presenting the service flow

Execution of the task which has an administrative act as output results in presentation of the document template as depicted by Figure 15.

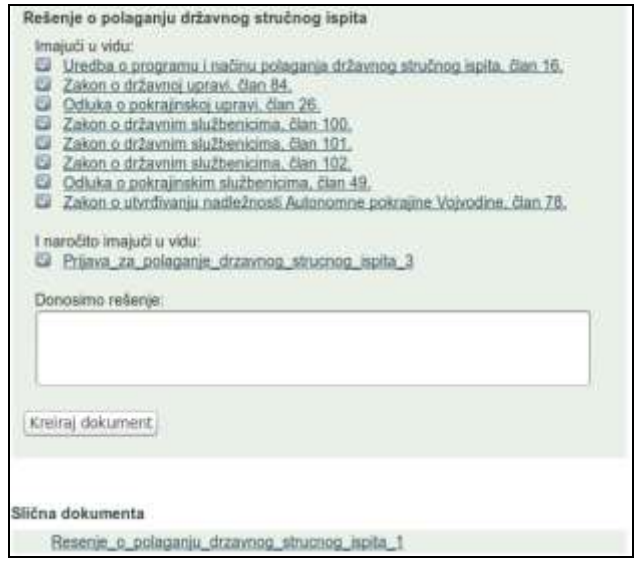
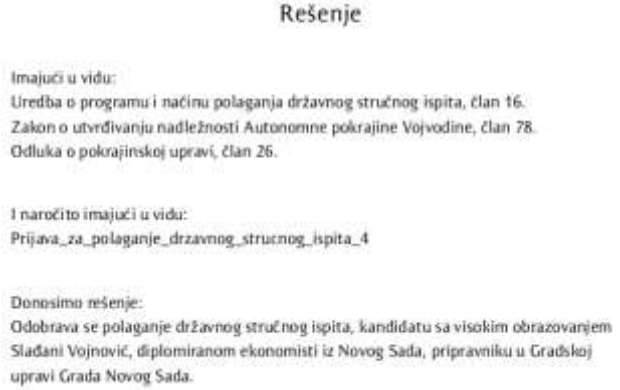


Figure 15. A template for creating an administrative act

On the top of the page are the links to legal documents regulating the service's domain with check boxes for including/excluding the document in/from the template of the document that is to be created. All documents that are "born" during the procedure execution are shown so they can be included into new document. On the page bottom are the links pointing to other documents of the same type. Some civil servant can than use these documents as examples, thus accessing the knowledge accumulated by others and improving his/her own professional quality and efficiency.

Creation of the document is accompanied with creation of meta data that is stored in both the meta data repository and the document itself which is stored in XML format. The system offers an option for downloading the documents in PDF format which is created directly from XML representation. An example of the PDF document that was created from the XML document is given in Figure 16.



Rešenje

Imajući u vidu:
Uredba o programu i načinu polaganja državnog stručnog ispita, član 16.
Zakon o utvrđivanju nadležnosti Autonomne pokrajine Vojvodine, član 78.
Odluka o pokrajinskoj upravi, član 26.

I naročito imajući u vidu:
Prijava_za_polaganje_drzavnog_strucnog_ispita_4

Donosimo rešenje:
Odobrava se polaganje državnog stručnog ispita, kandidatu sa visokim obrazovanjem Slađani Vojnović, diplomiranom ekonomisti iz Novog Sada, pripravniku u Gradskoj upravi Grada Novog Sada.

Figure 16. An example of the decree in PDF format created from XML document representation

5. CONCLUSION

The paper presents one prospect of the state of art and trends in the topics of open standards and open source code in eGovernment. Along with a brief overview, two examples illustrating possible applications of the OSSs to eGovernment are presented.

The overview shows that an open approach in the domain of standards is a mandatory prerequisite for building functional system of eGovernment. Today, all countries are building their national eGovernment interoperability frameworks based, at least declarative, on open standards. Despite the declarative consensus on open standards and interoperability in governance and administration, there i still a long journey to be passed before we reach the desired goal.

On the other hand, open source code applications become more and more a realistic alternative to vendor solutions for building software solutions to eGovernment in many software categories starting from communication and networking, server operating systems, etc. and ending with office applications. Radius, Squid, Nagios, Linux, Apache, Alfresco,

MySQL and PostgreSQL, Grass, PostGis, OpenOffice, etc. are sufficient to justify that prospect.

The presented case studies show that various implementations of eGovernment software are possible using OSS.

The issues of OSSs and their applications in governmental institutions are pretty "hot" topic due to the fact that government is set into position to balance between two opposite goals: the first that strives to exploit potentials of open approach in the domains of interoperability, transparency and cost reduction for governance/administrative operations; the second which is imposed by the role of government in economy management and the attitude advocated by some "big players" in software industry who are endeavoring to preserve or even improve their market positions. There are numerous examples of public administrations shifting towards OSS (Germany, France, Norway and, recently, Russia), but there are also the standpoints that contest the legal basis for preferential treatment of the OSSs in public procurements.

It is also important to mention the trend, which is becoming more and more present in governmental bodies, to make the existing software solutions in governance and administration open for governance and administrative subjects that did not directly participated in their development and realization.

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e-Health Services in the Integrated Health Care System

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Abstract: **e-Health, as a key component of the contemporary and efficiently organized integrated health care system, presents an important part of every e-Government. e-Health users could be classified into several categories. For each of them a specific set of services should be provided. In order to design and implement a high-quality e-Health, it is necessary to clearly define all e-Health functionalities, especially through services for certain categories of users. Therefore, this paper describes the functionalities that modern e-Health should provide, with the emphasis on e-Health users.**

1. INTRODUCTION

Health care systems are different from country to country. The European Commission recognizes five basic types of the health care systems (Anglo-Saxon, Continental, Scandinavian, Mediterranean and Eastern-European) [1]. Many of them are characterized with hierarchical structure with many levels, such as the health care system in the Republic of Serbia. The whole health care system in the Republic of Serbia is divided into private and state health care, where state health care system has multilevel organization (primary, secondary, tertiary). Having in mind all above mentioned types of health care systems, Serbia has the one which has the basis of the Scandinavian model (strong and immanent state health care), but in the transition towards the Continental model (the state guarantees the certain level of health care, but the private sector could provide better service in certain segments).

Almost inevitable precondition for efficient organization of the health care is the mass use of information and communication technologies (ICTs) in everyday functioning of the health care institutions at all levels. This trend of ICT use in healthcare came up to the introduction of the term e-Health. It could be said that in modern societies one of the most significant fields of development and use of ICT is actually e-Health, since this concept is not accepted yet even within most developed countries. Therefore, we are witnessing the organized state efforts, mainly in the field of introducing the medical information systems (MIS), of various levels of complexity, into the work of the healthcare institutions. With adequate services, e-Health is becoming one of the key elements of the e-Government in all countries.

Existence of the adequate information system could improve the efficiency of the business processes and procedures in this field, which caused the development of the medical information systems. In the last twenty years, this trend was developing very slowly in our country. The reasons for slow implementation of information technologies into health care are different: the lack of informatics infrastructure, inadequate software solutions, and great resistance of the medical staff towards establishing of the information systems. However, the necessity of establishing the MIS has been recognized lately, so the period of intensive work in this field is ahead [2]. At the global level, it has been considered that during the next decade, the most of the funding will be allocated to the development of e-Health [3]. In support of this claim is the fact that after the finalization of the project "Development of the Health care Information system for basic health and pharmaceutical services in Serbia" [4], the DILS

project was established [5]. The World Bank approved loan of 32 million Euros for DILS project, where 12,5 million (39%) is planned for improvement of the primary health care in Serbia. The project will be implemented in the next four years, with the aim to provide additional assistance to the existing reform of the primary health care. The goal is to provide capacity building for institutions, to improve accessibility, efficiency and quality of services provided at the local level. One of the four components of the project is also the establishment of the information systems in 157 primary health care centers in the Republic of Serbia.

2. EXPECTED EFFECTS OF E-HEALTH

In order to have well organized and functional health care system, it is necessary to make great effort for the purpose of improvement, standardization, integration and collaboration of the IS healthcare institutions. Such system should include all segments and levels of work in the healthcare institutions on one side, and on the other side the system should provide adequate service to the users of healthcare, i.e. to other state institutions and services in the country (e.g. Ministry of Health, Republican Institute for Healthcare, Republican Institute for Statistics, etc.) (Figure 1).

In order to give e-Health's full contribution to the improvement of healthcare efficiency, it is necessary to have a clear idea on what are the expected features. Having in mind the fact that this integrated system should function on the national level, it is necessary to define services and type of beneficiaries. It is necessary to establish which relations exist between certain parts of the system, what type of beneficiaries exist, which sets of data are accessible to which type of beneficiaries, how to import old paper records into new digital system, etc. As a rule, medical information systems, as one complete software solution, should realize support for [6]:

- Basic (medical) activity,
- Following business processes (mainly administration and accountancy)
- Planning and management,
- Improvement of commercial position for the targeted medical institution,
- Efficient education and
- Scientific and research work.

Figure 1: Structure of the health care system

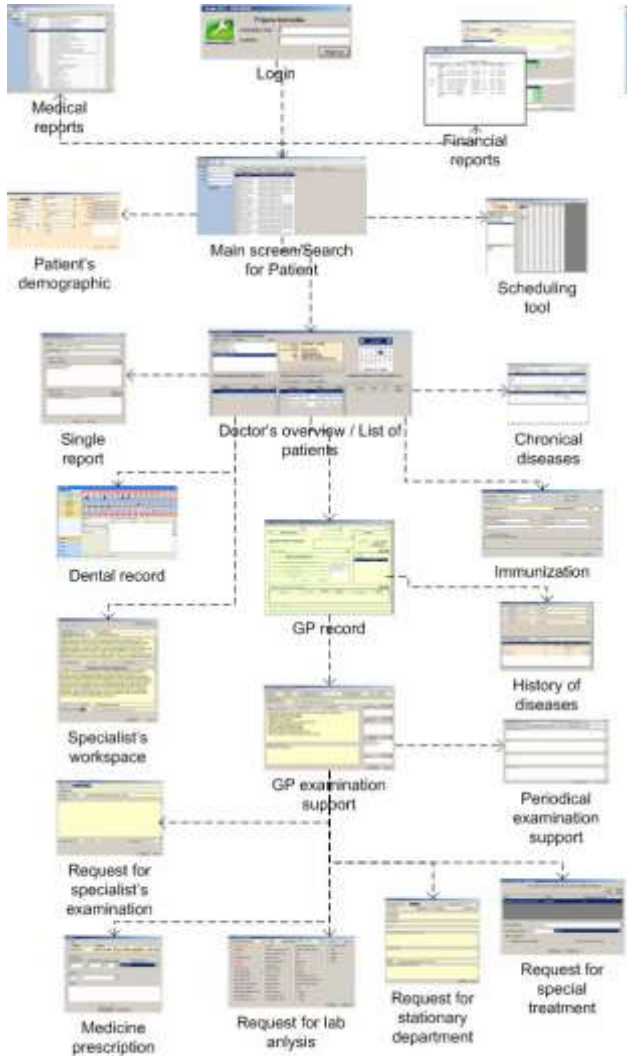

Figure 2: MEDIS.NET information system

The effects realized through implementation of one adequately designed, realized and exploited medical information system are multiple, and some of them are:

- Increase of efficiency treatment by decreasing the average time of treatment, i.e. shortening the time of service provision, by shortening the time necessary for administrative part of the service.
- Higher level of resources usage (capacities, equipment, human resources) based on planning and appointments.
- Functioning on principle of cost, based on regulations of medical services and obtained prices.
- Efficient record keeping on provided medical services.
- Efficient control of supplies (medicaments and other medical supplies)
- Systematic and simple work planning.

- More quality work for medical and non-medical staff.
- Efficient and wider implementation of the health care program.
- Current information on the situation with working processes.
- Creation of basis for quality education of all medical workers, as well as healthcare service beneficiaries.
- Qualitative and wider elements for scientific and research work.
- Etc.

All the services offered within the system of e-Health actually present the services of one customer's service. Customer's service is the central part of the system, which distributes data upon the request of beneficiaries, and at the same time, provides the necessary level of security and privacy. Customer's services usually have several parts, and in order to access these parts it is necessary to have authorization. The service contains parts related to patients, clinic staff and researchers.

In this paper we present the overview of the necessary services that should be implemented through the system of the e-Health, in order to achieve all current and future demands and needs of modern society in the field of health care and wider. Beside the review of necessary services, we also present the practical implementation of some services realized as the part of the medical information system MEDIS. NET (Figure 2) developed within the projects of the Ministry of Science and Technological Development of the Republic of Serbia (TR 1.047 i TR13015). Some of these modules are already implemented in practice.

3. MEDICAL INFORMATION SYSTEMS

The usage of information technologies is more and more spread on all fields of human activities with the aim to increase the system efficiency and achieve complete record keeping of all segments of work processes. Beside the record keeping, usually there is a need to make important decisions for the further development strategy of the legal entity based on existing data and wide analysis. Therefore, in the developed countries the healthcare system achieved significant progress by acquiring information technologies in many clinical and administrative processes. The whole process of establishing the medical information systems began in 70' during the 20th Century, but the peak of the development was achieved ten years ago, when the informatics structure became much better and when the society realized that the medical information systems are really necessary.

Medical Information Systems (MIS) [7] with implemented Electronic Patient Record (EPR) [7] or the Electronic Health Record (EHR) enable electronic input and update of provided services, documentation, review of results, as well as support in decision making – in the real time. As a rule, the medical information systems contain detailed information on almost all daily activities and therefore they have great value in medical, financial and administrative sense. Lately, the human resources engaged within the healthcare system realized the advantages and possibilities offered by MIS. Therefore, staff is more and more interested in the analysis of the huge amount of data that follow daily activities, in order to get answers for many questions they have in everyday situations.

In future, these systems will be used more and more, especially when the healthcare institutions start using the principle based on number of provided services, efficiency in

treatment, as well as on the satisfaction of the healthcare service beneficiaries. Therefore, it is necessary to develop IT systems within the healthcare that would be able to provide adequate results and efficient generating of various reports and indicators. Actually, these reports and indicators will directly affect the amount of financial means that would be allocated from the Republican Institute for Health Insurance to the healthcare institution.

3.1. Beneficiaries

There are a lot of different beneficiaries of the medical information systems and they could be classified into certain categories, i.e. subcategories that are characterized, among the rest, with the sets of privileges. According to their privileges, certain groups of beneficiaries have certain possibilities for using the medical information system, i.e. right to have access to certain functionalities, or services offered by MIS. Beneficiaries of the integrated medical information system could be divided into two large groups: healthcare workers and other beneficiaries. The category of healthcare workers could be divided into certain subcategories: doctors, nurses, technicians, healthcare institution management. The category "other beneficiaries" could be divided into following subcategories: patients, citizens, students (all levels of studies – master and PhD studies, specialized studies), faculty teachers and associates, researchers, other systems (e.g. employees in the Ministry of Health, or Republican Institute for Health Insurance, Batut Institute, or Ministry of Internal Affairs), auditors. This last category has special privileges and could access more data than other beneficiaries.

This big number of category beneficiaries of MIS inevitably requires larger number of different functionalities, i.e. customers' services which could be implemented only with adequate integration or collaboration of all parties of the healthcare system. The complete implementation of one system means phases implementation, but also means the design of the whole system that will allow phase implementation and later changes and adding new features, or whole modules. In order to design the system successfully, it is necessary to specify all subsystems, their relations and interactions, as well as main features of the subsystems [8]. Also, it is important to emphasize in which direction will development of the medical information system go, in the country and worldwide.

3.2. Functionalities

The most important functionalities and services that MIS should provide will be discussed in relation to the groups of beneficiaries [9]. For the medical staff, people who directly provide health care services to the patients, MIS should provide following:

- Record of organizational units
- Record of employees (input, update, erase, reporting)
- Generating of electronic invoice in accordance with the request of Republican Institute for Health Insurance
- Medical record of the patients according to their age and gender (pre-school children, school children, adults) (Figure 3)
- Medical record of specialized services (e.g. dental chart, gynecology chart, rehabilitation chart, etc.) (Figure 4)
- Examination of patients and diagnosis
- Generating the receipts, doctors reference (laboratory, specialized, for stationary treatment, reference for commissions, sick-leave, etc.)
- Record on visiting history

- Scheduling for medical services (Figure 5)
- Work of bio-chemical laboratory
- Work of all specialized services with all the specific features they have
- Work of diagnostic devices
- Working schedule for doctors
- Personally chosen doctor (Figure 6)
- Various reporting, etc.

For the management of the healthcare institution it is necessary to provide following:

- Records on organizational structure of the healthcare institution,
- Schedule of employees by organizational units,
- Schedule of employees by services,
- Records on absence from work for employees, record on employees efficiency (preparation for the process of capitation)
- Recording of the consumption and allocation of medical supplies and medicaments,
- Recording of the vehicles,
- Financial management,
- Support to the management through strong BI analytics aimed to the follow up, planning and anticipation,
- Information for healthcare workers (meetings, scheduling, work efficiency, emergency cases, etc.),
- Automatic invoice of services towards Republican Institute for Health Insurance (Figure 7)

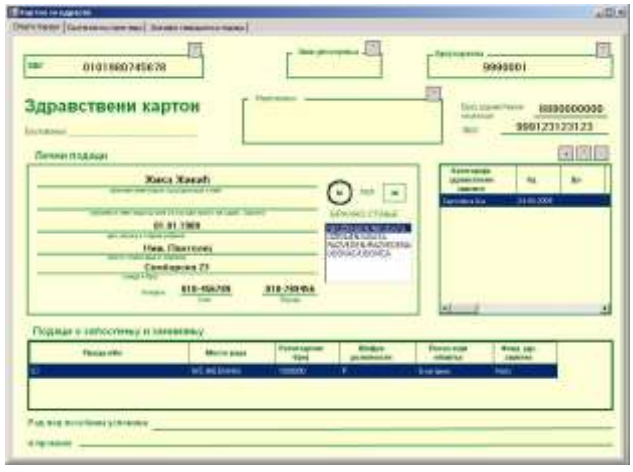

Figure 3: One view to Electronic Health Record

Patients should be provided with various services that could be classified within the category of basic or necessary and needed, such as:

- Possibility to choose personal doctor for 4 specialties (general practice, gynecology, dentist and pediatrician).
- Insight of the working hours of services and doctors.

- Possibility to schedule an appointment for certain type of service (examination, diagnose, therapy, etc.) at the doctors' office, through adequate Call Center or via Internet.
- Possibility to access the results of the certain services via Internet (for example, the results of the bio-chemical analysis)
- Post a question to a doctor.
- Prescribing the recipe for chronically ill patients without visiting the doctors' office.

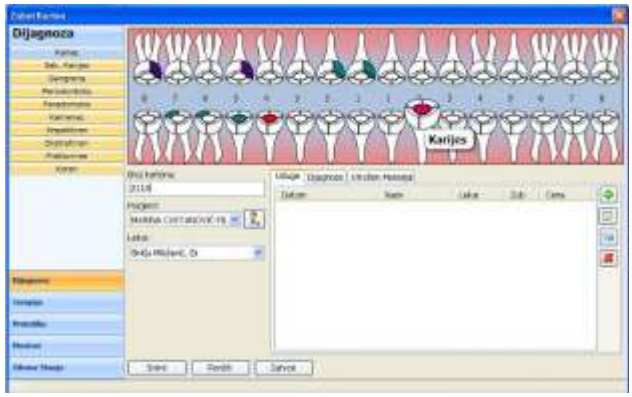

Figure 4: Patients' Dental Chart

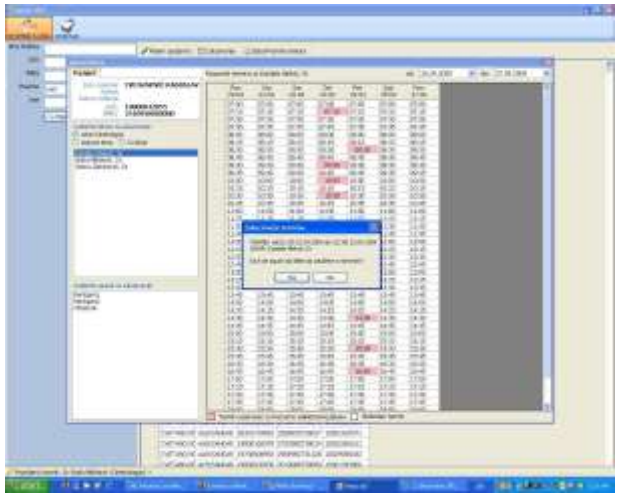

Figure 5: Service for scheduling an appointment – Call Center

For the purposes of education it is necessary to provide set of features necessary for pointing interesting cases and appropriate documentation from the patients' health record, i.e. history of disease, as well as using of this data. In order to secure privacy, all data are demilitarized by general rules. At the same time, it is necessary to provide access to general data (e.g. number of patients suffering from certain disease for certain period of time, relation of male and female patients, effects of work place, place of living, risk factors for certain diseases, etc.) (Figure 8). Educational material should provide support for all forms of data that exists within MIS: textual, numeric, graphic, audio, picture and video.

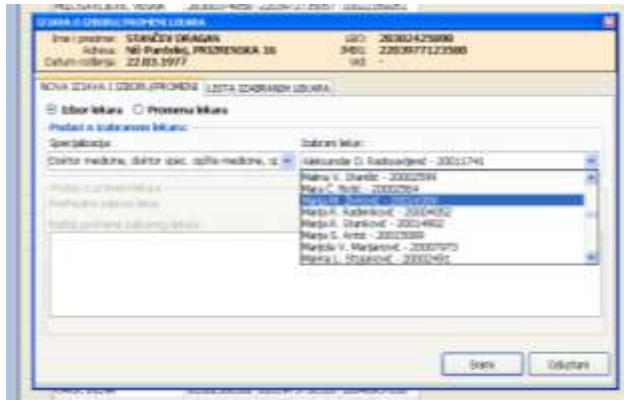

Figure 6: Support for choice of personal doctor

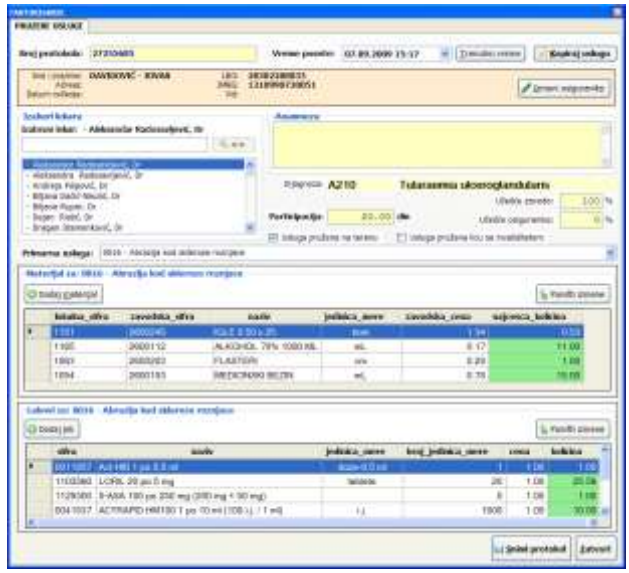

Figure 7: Service invoicing

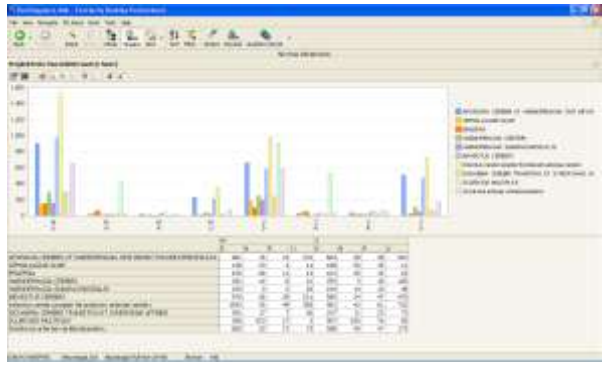

Figure 8: BI support

For the purpose of scientific research, or research carried out as a part of specialized works, master thesis and PhD dissertations, it is important to enable access to medical documentation with necessary secure of privacy of patients' health information. In order to have easier manipulation and analysis of data, it is necessary to provide flexible multilevel search mechanism for different types of data (one of them is ReportER [10]) or appropriate BI support.

For the needs of other systems within the state administration (such as police or court) it is important to provide services for access to certain data (e.g. patients' dental chart) or provide services to access certain gathered data for the needs of the Ministry of Health or RZZO.

4. INTEGRATION AND COLLABORATION

Medical information systems of so called closed type are less significant, since they are not able to provide information exchange with other similar systems. Existence of independent information systems within certain medical institutions or just within some parts of institutions, does not meet the growing requirements for information exchange. Therefore, two processes are rising up as an imperative: process of integration and process of collaboration [9]. These processes are not simple, especially when single MIS are heterogeneous. In order to have integration, i.e. collaboration it is necessary that all MIS meet certain standards (for example MKB10 [11], openEHR, HL7 [12], DICOM, etc.).

Ways to achieve integration and collaboration of the information systems in the medical institutions will surely for a longer period stay an open problem, due to the constant advance in the field of information technologies and complex and non-unique structure and organization of medical institutions. Within one country, this big step is not possible without strong support of ministries and institutions, especially considering standards for information exchange between the systems of one healthcare level, or between the levels.

Therefore the medical information system MEDIS.NET is based on Electronic Health Record of the patient, which is related to the patients' personal health record kept in digital form. Realized health record fulfills some of the above mentioned standards, mainly openEHR for internal system organization and HL7 for data exchange. HL7 is related to the context of integration and collaboration of the information systems in medical institutions, since all medical institutions in the country represent the parts of the system, where more or less cooperation between certain medical institutions is inevitable.

The main idea, borrowed from the openEHR, is the existence of broad able model of data, and the uniform structure concept was taken from the HL7 model. This enables the creation of sets of objects at the highest level of hierarchy, which could be transferred to other systems, and which will be supported due to their openEHR archetypal structure.

Basic sub segments of the used EPR are:

- Participants and contacts
- Basic electronic health record
- Organizational structure of the clinic
- Link with insurance and support to payment
- Privileges and roles
- Archives

It is important to mention that above mentioned segments are not strictly mutually separated, and there are horizontal links between them. However, at the same time they are separated enough for forming the structures for data exchange, which will be related separately to each of them.

5. RECOMMENDATIONS FOR MIS REALIZATION

During the designing and realization of the services provided for beneficiaries by MIS, or generally e-Health, some practically confirmed principles and approaches should be followed. Some of them are following:

- To perceive MIS from perspectives of all current and future beneficiaries and their needs
- Short training
- Avoid resistance of beneficiaries (examine and keep the everyday routine of the current beneficiary's work)
- Unique interface at all levels of IS
- Easy and quick selection of values for data input
- Data is entered at one spot and is accessible everywhere
- Reduce errors to minimum (choice instead of input, alert for all unusual deviations)
- Allow large scale of accessible data
- Always take into consideration change of regulations
- Allow advanced use of IKT in medicine (support to decision-making, consultations, portal for rare diseases, etc.)
- Allow diversity through reliable system of configurations and privileges
- Do not meet only the current requirements directed by the needs of RZZO, design medical or clinical part
- Multilevel reporting
    - Standard fix reports
    - Reports with dynamic created criteria
    - OLAP
- Different forms of reports (text, tables, graphs, tree maps, etc.)
    - Paper form
    - Web
- Provide work even in "not perfect conditions" (for example do not rely on perfect internet connection)
- Design of appropriate web services for collaboration
- Be open for further integration and collaboration, etc.

6. CONCLUSION

Implementation of e-Health as the key component of the e-Government is one of the main activities that is ahead, not only in our country, but in many more developed countries. In order to design and implement efficient e-Health, which will provide all necessary functionalities to a

wide scope of beneficiaries, it is necessary to define groups of beneficiaries. Another key activity is to identify all functionalities or groups of functionalities needed for certain categories of beneficiaries within the e-Health system. The previous should be followed with the phase of design and implementation. This paper identifies the categories of e-Health beneficiaries, further indicates all key e-Health services which should be provided to certain categories of beneficiaries. During the phase of design and implementation of e-Health it is important to follow some recommendations that are also mentioned in this paper. As an illustration, great number of pictures of MEDIS.NET system is enclosed in this paper, presenting a good practice example, which is already confirmed by the license issued by the Commission for Accreditation of the Ministry of Health of the Republic of Serbia.

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Web Technologies for Interactive E-Government

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***Abstract*: Web 2.0 technologies are getting increasingly more important role in everyday life of a massive number of people. As a consequence governments are under strong pressure to address the challenge and accordingly make progress toward Government 2.0. In this paper, enabling technologies for the Government 2.0 will be discussed in this paper. Those technologies start to be increasingly used for provision of public services, improvement of managerial effectiveness and promotion of democracy, a development that is commonly termed as E-Government. The E-Government services represent the cornerstone of the participative government where people and institutions are involved at personal, community, knowledge, as well as policy levels. Qualitatively new value for individual citizens is being achieved at participation at the level of whole society where the social informatics services are of crucial importance.**

1. INTRODUCTION

Given the manifold semantic differences of interpretation of, for example, law, regulations, citizen services, administrative processes, best practices, as well as many different languages to be taken into account within and across regions, nations and continents, make e-government domain unique[1] with respect to the challenge of achieving interoperability. E-government services require information integration as well as process integration involving a variety of objects with specific semantics [1]. In the same time, governments today are rapidly progressing toward 'Government 2.0', which is characterized by its citizen-oriented services enabled by information sharing and facilitated participation [2]. Web 2.0 technologies are used to transform government services from government-oriented to citizen-oriented government based on information and service sharing, new government services oriented toward the demanding side, and easy participation of citizens. Governments widely use Web 2.0 applications such as social-networking sites (for example Facebook), blogs, wikis, twitter, mashups, search engines, etc [1],[3],[4],[5],[6],[7]. The next step, or Government 3.0 so called, is expected to be a Semantic Web-based government that personalizes all government services according to the conditions and preferences of each individual [2]. The Semantic Web provides tailored services for each individual and allow semantic search of requested information via websites and databases [8].

In this paper, we give an overview of new web technologies that start to be used by governments worldwide with attention to web 2.0. The paper is organized as follows: Section two gives review of new technologies that start to be used within e-Government domain, such as Web 2.0 and Semantic Web. Section three presents short overview of innovative applications in e-Government usage. Finally, Section four concludes the paper.

[1] http://www.aaai.org/Press/Reports/Symposia/Spring/ss-06-06.php

2. E-GOVERNMENT: NEW TECHNOLOGIES

2.1. Web 2.0

Communities, states and the federal government attempt to implement the tools and technologies developed and adopted by the private, commercial sector of the economy that extend the utility of the Internet. Government 2.0 in general describes efforts of that implementation, while such efforts are collectively known as Web 2.0 [5]. The term Web 2.0 is commonly associated with software-intensive systems based on Internet and featured with high level of human participation that further facilitate interactive information sharing, interoperability, user-centered design and collaboration on the World Wide Web.

Based on O' Reilly and Forrester research [3], Web 2.0 is composed of a set of technologies (Ajax, XML, Open API, Microformats, Flash/Flex,), applications (social-networking sites, blogs, wikis, multimedia-sharing sites, hosted services, content sharing, tagging, mashups, folksonomies, rss feeds, search engines, etc.), and "values" (User as producer, Collective intelligence, Perpetual beta, Extreme ease of use).

Many government leaders recognize the opportunities Web 2.0 technologies provide not just to help them be elected, but to help them do a better job also [1]. Web 2.0 can help government enhance its existing relationship with citizens by creating new avenues of interaction [5].

Social networks: Facebook

Social-networking sites have long been viewed as a way to connect people to people. Increasingly, they are being used to connect people to institutions [4]. One of the most famous social networks web sites is Facebook launched in February 2004, privately owned by Facebook Inc. CA. Nowadays, Facebook counts more than 500 million active users[2]. The common features are the Wall, Pokes, Photos, Status, News Feed, Instant Messaging (Chat), Gifts, Martketplace etc. Facebook allows making new connections to those who share a common interest, and expanding personal network in that way. Users share a variety of information about themselves including photos, contact information, and tastes in movies and books. However, Facebook starts to be used in government world also. For example, San Francisco's Facebook page already has more than 260,000 fans. The page announces city activities and gives users a place to comment on community issues. It also offers links to city services and video from city government-related events[3].

Wiki and Social Tagging

Wiki can be identified as a pervasive technology for knowledge management and group collaboration. Wiki is software, knowledge and community. In [9], wiki is identified as a set of linked web pages that are incrementally created by a group of users that collaborate between themselves. The incremental nature of wiki results in creation of a system storing shared knowledge coming from multiple sources. On the other side, we also refer to wiki as a website that allows users to add content that may be editable by other users [10]. Some of the common wiki features are: browser independence, text editing, embedded images, numbered, bulleted and hierarchical lists, tables, embedded multimedia, search, emoticons, calendar, RSS, link checking, drawing tools, equation editor, and many others that can be embedded into wiki

[2] Facebook Statistics, http://www.facebook.com/press/info.php?statistics

[3] http://www.govtech.com/e-government/Will-Facebook-Replace-Traditional-Government-Web.html

using standard plugin mechanisms. Wikis are applied in many different fields and for many different purposes. Wikis are flexible enough to support a variety of application domains. Each wiki site has community protocol followed by the users' community. Wiki is a new social interaction medium where new form of intellectual artifacts called 'live artifacts' can be published.

The collaborative and interactive nature of the wiki gives everyone an opportunity to participate in identifying the best possible solution [5]. Thus, wiki could be used to standardize business processes, functions and terms across an entire government [5], since Government is typically broken up into departments, each with its own unique functions. The advantage of a wiki is that many more employees are involved in creating and editing the content, where the process happens faster, and employees actually read it and use it because they are involved in it. Wikis are usually enriched with social tagging capabilities since it represent a natural fit for the unique navigation needs.

Tagging represents a common way of organizing collected information for navigation, filtering and search [11]. Social tagging allows individuals to organize and share content and provide information categorization for themselves as well as browsing the collected information categorized by others. Nowadays, social tagging capabilities can be found in a number of major music, news, video, and e-commerce websites, as well as on social network sites and enterprise systems. In [12] is proposed concept of tagging as an approach to systematic arrangement of shared knowledge stored within a wiki system. The example of tagging on a wiki personal profile page is shown in Figure 1.

Figure 1 Social tagging and wiki: personal profile page

Blogs

Blogs (or weblogs) have become increasingly popular over the last ten years, spreading to all spheres of the net: private, academic, cultural, professional and commercial [11]. Blogs were originally created to essentially be online diaries, and blogging was a way to combine a personal Web page with tools that made linking to other pages and applications easier [5]. In general, a blog is website usually maintained by an individual with entries in the form of comments, descriptions of events, or others such as graphics or videos. Blogs are interactive websites where visitors can leave comments and messages via widgets on the blogs. Many blogs provide comments or news on a particular subject. A typical blog combines text, images, and links to other blogs, web pages, and other media related to its topic. Most blogs are primarily textual, although some focus on art, photographs, videos, music and audio. Since

2007th year blog search engine technorati[4] tracks more than 112,000,000 blogs. Consequently, blogs become popular in government, also. For example, the U.S. Government counts more than 50 blogs that publish official information and services[5].

Mashups

A mashup is a web application that integrates services and/or data from two or more online sources to create a unique service that meets the situation needs of a particular group of users [7]. The main characteristics of mashups are combination, visualization and aggregation. Mashups are viewed as the next wave of end-user development [7]. There are many types of mashup, such as data mashups (combine similar types of media and information from multiple sources into a single representation), consumer mashups (combines different data types from multiple sources), and enterprise mashups (define applications that combine their own resources, application and data, with other external web services). Figure 2 shows example of mashup where several services are involved.

Figure 2 A mashup example: combination of several services

Web page shown in the Figure 3 represents one more example of the integration of several services: YouTube video, wiki, slideshow, tagging and comments service.

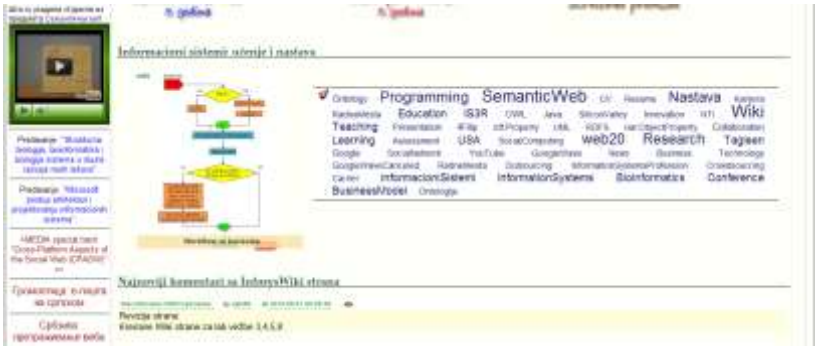

Figure 3 A mashup example: Video from YouTube + Wiki + Slide show + Tagging + Comments

[4] http://technorati.com/

[5] http://www.usa.gov/Topics/Reference_Shelf/News/blog.shtml

Figure 4 Twitter: SMS messages on the web

Further, mashups is often seen as a fundamental aspect of Government 2.0 collaboration and open government. Mashup services allow government organizations and citizens to easily share and utilize government data and services. Those services are expected to improve cooperation between ministries and between public and private bodies, enhance service levels, and create new businesses and industries [2].

Twitter

Twitter (see Figure 4.) is a microblogging (a broadcast medium in the form of blogging, but with much shorter content units) platform, which allows users to post short text messages (up to 140 characters) and converse with other users via their phones or web browsers. This platform is widely adopted in the UK (among others) and being used increasingly by government departments, Members of Parliament, millions of businesses, non-government organizations and individuals [13]. Twitter has gained popularity worldwide and currently has more than 100 million users[6]. Twitter account is related with the government's blog for the most government agencies. Nowadays we are getting government agencies that are not only blogging, but also using TwitterFeed to promote the posts through Twitter.

2.2. Semantic Web

According to [2], Semantic Web is an artificial intelligence web technology that enables computers to define, understand and logically deduct the meaning of information and data present on the Web. The **Semantic Web** provides a common framework that allows **data** to be shared and reused across application, enterprise, and community boundaries, and represent a group of methods and technologies to allow machines to understand the meaning (or semantics) of information on the World Wide Web. Gartner[7] predict that by 2012, 70% of public websites are expected to utilize some form of Semantic Web technologies. Today, several commercial companies as well as non-for profit organizations are developing

6 "Twitter snags over 100 million users, eyes money-making". http://economictimes.indiatimes.com/infotech/internet/Twitter-snags-over-100-million-users-eyes-money-making/articleshow/5808927.cms. Retrieved April 15, 2010.

7 http://www.gartner.com/

ontologies for eGovernment (for example goeGOV[8] is making and publishing W3C OWL[9] ontologies for eGovernment).

The Semantic Web relies heavily on formal ontologies that structure underlying data for comprehensive and transportable machine understanding. Ontology defines the set of terms used to describe and represent a given area of knowledge, and identify them as things that can be *concepts* (representing basic generalization of things in the knowledge domain), and the *relationships* that may exist among things codified as *properties* (or *attributes*) those things may have. Ontologies also facilitate formal representation of different meta-data descriptions of the domain specific concepts and relationships. Ontologies are commonly considered as a key element for semantic interoperability, and information exchange between computers and humans in high complexity environments, providing an effective means for representing information in high levels of abstraction [8].

Value proposition of building ontologies for eGovernment is very strong since it promises to solve a long lasting problems in governmental data management by enabling distributed creation and maintenance of formal information on data (such as where and when data are created and used, for what purpose, within what administration scope, etc.). In this way standardization of neutral models for data exchange and transformation becomes feasible with an immediate benefit of extending life cycle of the data. The use of standard RDF/OWL formats for encoding semantics of the data represents strong foundation for intra-departmental aggregation of data that traditionally was a burning problem due to different interpretation of data and the lack of shared precise semantics and controlled vocabularies. By formally encoding provenance meta-data and integrating it with the data that it describes, ontology based data management enables navigation over who is publishing what in what format as well as provenance and trust in the sources of data.

3. E-GOVERNMENT USAGE

As an immediate answer to the global challenge of rapidly growing user base of Internet in recent years, public authorities of countries worldwide have aligned efforts to put together more or less sophisticated electronic services and offer them to their citizens. While some countries have already developed services of full online transaction, communication and service handling, others are only offering basic information [14]. Regardless of the level of sophistication of the existing services, there is an urgent pressure for establishing solid foundation for technology mediated social participation [16] within as well as around government. Being the most fundamental public service, government is challenged to adopt to the new needs of citizens for effective public service infrastructure facilitating participative open interaction among people, services and data.

Table 1 shows paradigm shift of government services through years [2] as past (Government 1.0), present (Government 2.0) and future (Government 3.0). The comparison of the services should not be considered as a strict guideline, but contrary it is more like indication where the future trends would be heading to.

[8] http://www.oegov.org/

[9] http://www.w3.org/2004/OWL/

Table 1. Government Services Progress

1995 ~ 2000 World Wide Web **Government 1.0**	**2005 ~ 2010** Web 2.0 **Government 2.0**	**2015 ~ 2020** Real-World Web **Government 3.0**
Government-oriented	Citizen-oriented One-stop-shop	Government service portal for individuals
One-way service	Bilateral interaction	Customized intelligent service
Time and place restrictions for services	Mobile services	Seamless services anytime and anywhere
Uniform services mainly based on supply	Services based on public-private collaboration	Intelligent services

Identified areas of application of eGovernment can be divided on back office (networked employees) and front office (networked citizens) [15]. Back office primarily relates to the data and process related issues such as: regulation, cross-agency collaboration, knowledge management, interoperability, human resources, public procurement, and innovation. On the other side, front office is focused on social interaction and participation that is expected to provide radically improved service and to create new value in the near future [16]. Front office is where the whole public attention is focused on and includes: service delivery, eParticipation, law enforcement, public sector information, public communication, transparency and accountability, inclusion.

4. CONCLUSION

In this paper, we gave brief overview of new technologies for participative and interactive eGovernment. This paper covers overview of several applications of Web 2.0 such as: social networks, wiki, social tagging, blogs, mashups, and micro-blogging; and related it to matter relevant for eGovernment. Further, data management based on ontology development and specifically Semantic Web as the most exposed approach are discussed with attention to eGovernment. New advances at the application layer of the eGovernment stack are shortly discussed, too.

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The role of software evolution and maintenance in the context of e-government change management

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Abstract: **Information and communication technologies (ICT) have been used in many organizational environments since their introduction. Political, economical, sociological or technological factors influence the change of organizational environments. Dynamic nature of an organization requires changes to ICT infrastructure that supports the functioning of the organization. An important segment of an ICT infrastructure is software that also must change in order to remain usable. Understanding the importance and the need for implementation of software maintenance and evolution concepts plays the central role in ensuring software usability in changed organizational environments. This paper outlines the basic concepts of software maintenance and evolution and their role in e-government change management.**

1. INTRODUCTION

Technology advancements, competition, globalization, the need to optimize cost and increase efficiency, and increased customer expectations force organizations to evolve in order to survive [1][2]. Successful implementation of change in an organization requires understanding its nature and dynamics. However, many research studies have reported that approximately 70 percent of planned organizational change initiatives fail [3].

Organizational changes can be in forms of restructuring, introduction of new technology, mergers, or acquisitions. According to Walker et al. [4] factors that influence change success are: content, process, context, and individual differences. Change content refers to the change being implemented and it is organization specific. Process refers to the actions that are taken during the implementation of the change. Context refers to pre-existing forces in an organization's environment. These forces may be external (competitive pressure, governmental deregulation, or legislative and technological changes) and internal (levels of professionalism, managerial attitudes toward change, managerial tension, technical knowledge resources, and slack resources). Variety of different individuals within an organization influence attitudes and reactions to change and commitment to change. Various internal and external factors can trigger organizational change [5]. According to Chou internal factors are strategy, structure, operations, culture, award, politics, leadership, management and technology. External factors are economic status, political and legal systems, socio-cultural atmosphere and technological advancement.

Governments extensively use information and communication technologies (ICT) in their daily operations and businesses. ICT can increase the quality of e-government services and improve information management. Usage of these technologies introduces the term electronic government, or e-government, that is not uniquely defined in literature [6]. In practice, the definition of e-government evolves with the changes and growth of the scope of e-government capabilities and concepts [7]. Gil-Garcia and Martinez-Moyano [8] defines e-government as the use of information and communication technologies in government settings. According to

Beynon-Davies [9], the term e-government refers to the use of ICT to change the structures and processes of government organizations. Beynon-Davies proposed a model of re-designing governmental processes around ICT. On the basis of proposed model, Beynon-Davies further developed the agenda for successful e-government organizations regarding ICT usage:

- Back-end integration and customer-centered information systems,
- Back-end/front-end integration of systems to provide added-value interaction,
- Prioritizing service delivery and considering other stakeholders such as suppliers, partners and employees.

Due to the specific role in the society and many limitations (e.g. rigid structures and political reasons), organizational changes are achievable only to a certain limit in e-government [6]. That means that changes must be carefully tailored and adapted to these organizations. Effective change management requires development of a change model that covers all relevant aspects of a change.

Technological changes relate to hardware and network infrastructure, installed software and various documents used in a deployed ICT system. In the context of an e-government organization, there are two directions of change impact and propagation.

The first direction of change impact is from changes in ICT to changes in organization. This means that changes in any segment of ICT infrastructure (software, hardware, network and communication infrastructure and documentation) influence changes in the organization. Furthermore, any change in ICT infrastructure leads to changes in software systems. Effective management of software changes requires support of software evolution and maintenance methods and techniques. The second direction of change impact is from changes in an organization to changes in ICT. In practice, this means that ICT system must adapt to changed environment in order to support all stakeholder roles in e-government [10]. Changes in ICT are reflected on both hardware/networking infrastructure and software. In practice, a segment of the organization that is most exposed to changes is information system (IS), that is based on software systems and database repositories. Therefore, controlled evolution and maintenance of software and database segment of an IS in an organization plays a crucial role in change management.

The rest of the paper is structured as follows. The next section presents basic concepts of IS change management in e-government organizations. The third and the fourth sections outline the basic concept of software evolution and software maintenance that are support for effective IS change management. The role of software evolution and maintenance, as well as some directions on their inclusion in e-government change management are outlined in the conclusion section.

2. INFORMATION SYSTEMS AND CHANGES IN E-GOVERNMENT

Information system plays an important role in organization's change management. IS automates tasks, facilitates and directs the process of change, ensures the effectiveness and efficiency of the organizational change, and maximizes the benefits of change [5]. Successful change management reveals e-government organizations' transformation levels or maturity levels [11]. Papantoniou et al. distinguished the following maturity levels of IS in e-government:

- *Static information*: presentation of static information to citizen without any form of interaction,
- *Citizen interaction*: interactive services are provided to citizens (search, email, forms, call centers),
- *Knowing the citizen*: additional personalization is offered to the citizens, past transactions record tracking, and introduction of Customer Relationship Management (CRM) systems,
- *Full e-government transformation*: transforming e-government to a "home for the citizen", and deployment of knowledge management systems within government departments.

Many models and frameworks have been proposed to help organizations to understand and manage the change process [12]. Macredie and Sandom provide an overview of various change management approaches used in organizations, like the planned approach, the emergent approach, the contingency approach, IT-Enabled Organizational Change, and Orlikowski and Hofman's Improvisational Change Model.

Orlikowski and Hofman [13] developed the improvisational change model, that is the most similar to models used in IS change management [14][15]. The emphasis in the model is on the unpredictability of changes. The key dimensions of the change process in organizations are: the technology, the organizational context (including culture, structure, roles and responsibilities), and the change model used to manage change.

Nowadays, when technology change rapidly and has an open-ended and customizable nature, organizations should be flexible enough to adapt. Improvisational model of change [13] "recognizes that change is typically an ongoing process made up of opportunities and challenges which are not necessarily predictable at the start". In practice, a technological change is a collection of various changes. Some changes can be predicted, while others are unpredictable. Nilsson et al. [16] presented a study that confirms that municipal administration needs support to improvisational changes and guidance for the change process. This is supported with the evidence that the majority of employees have limited experience with technology.

According to Lyytinen and Newman, information systems' changes cover generation, implementation, and adoption of new elements in organization's social and technical subsystems [17]. Authors formulated a punctuated model of socio-technical change, that depicts IS change as a subtle interplay between technologies, actors, organizational relationships, and tasks at multiple levels.

Papantoniou et al. presented a change management framework in e-government supported by software tools that facilitate a change process with structured documents [11]. Proposed framework uses a collaborative intelligence infrastructure, called Case-Based Reasoning (CBR) [18]. CBR is method for solving problems by comparing a case situation to previously practiced ones. Case situations are stored in a case base repository. Framework contains three kinds of requests structured as XML documents: The Request For Proposals**,** The Request For Comments, and The Request For Change.

3. SOFTWARE EVOLUTION CONCEPTS

The key challenges of software maintenance and evolution are understanding, managing and reducing costs and risks inherent in change [19]. The evolution and integrity of a software product are in the focus of software change management. Software evolution includes changes to a software and related documentation. A standard definition of term software evolution still lacks [20][15], but some researchers and practitioners use it as a preferable substitute for maintenance [15]. Lehman defined evolution as a process of discrete and progressive change over time in the characteristics, attributes, or properties of some material or abstract, natural or artificial, entity or system or of a sequence of these changes [21][22]. The first law of software evolution formulated in 1974 by Lehman, called *Continuing Change* states: "*a large program that is used undergoes continuing change or becomes progressively less useful*" [21]. IEEE Standard Glossary of Software Engineering Terminology defines software integrity as the degree to which a software system or component prevents unauthorized access to, or modification of programs or data [23].

The concept of evolution is in late 1960s involved by Lehman as continuing program growth. The whole concept of software (program) evolution is based on Lehman's SPE taxonomy of evolving software systems [21] that is later refined as SPE+ taxonomy [22]. Lehman defined an E-type program as a program that interacts with its real environment where it operates and evolves in time. Lehman proposed lows of software evolution in order to identify its causes and processes [21]. These lows are later revised and adapted [24][25]. Formulated lows are not only related to software engineering realm, but also to management, organizational, sociological and user issues and activities. Lehman's lows of software evolution put a change in the central focus of software evolution. These laws capture knowledge about the common features of frequently observed behaviors in evolving software systems. The summary of eight refined lows of software evolution (with the year of the formulation of each one), taken from [25], is presented in the following list:

1. *Continuing change* (1974): E-type systems must be continually adapted, else they become progressively less satisfactory.
2. *Increasing complexity* (1974): As an E-type system evolves, its complexity increases unless work is done to maintain or reduce it.
3. *Self regulation* (1974): Global E-type system evolution processes are self-regulating.
4. *Conservation of organizational stability* (1980): The average effective global activity rate in an evolving E-type system tends to remain constant over the product lifetime.
5. *Conservation of familiarity* (1980): On average, incremental growth tends to remain constant or to decline.
6. *Continuing growth* (1980): The functional content of E-type systems must be continually increased to maintain user satisfaction over their lifetime.
7. *Declining quality* (1996): The quality of E-type systems will appear to be declining unless they are rigorously maintained and adapted to operational environment changes.
8. *Feedback system* (1974–1996): E-type evolution processes constitute multilevel, multi-loop, multi-agent feedback systems and must, in general, be treated as such to achieve significant process improvement for other than the most primitive processes.

Very important phenomenon related to software evolution is a feedback [25][26]. Lehman formulated Feedback, Evolution And Software Technology (FEAST) hypothesis that states [26]: "*As complex feedback systems, E-type software processes evolve strong system dynamics and with it the global stability characteristics of other feedback systems. Consequent stabilization effects are likely to constrain efforts at process improvement*". FEAST hypothesis is based on an observation that traditional development process must be part of global software process that spans activities through the whole life cycle. Software systems provide services in the real environments and stakeholders usually need feedback from different parts of the global software process. The purpose of feedback is to help stakeholders refine their requirements for the system. Because of the fact that various stakeholder groups for e-government [10] have different requirements towards e-government system [27], an effective feedback system plays a crucial role in evolution of software segments in e-government IS. An effective feedback system should ensure the long-term success of the e-government enterprise. These feedback activities should start in the system design phase through elicitation of system requirements, but they should be extended through the whole software life cycle. Successful software systems have a long period of maintenance after its delivery, and therefore effective feedback system plays important role as a support service. Kajko-Mattsson also identified continuous feedback as one of the main problems for customer satisfaction [28]. Other two problems for achieving customer satisfaction are meeting customer expectations, and improving relationship with the customers. Customer feedback is essential to change management [29]. Pierce focuses on direct communication with customers and leveraging their input to help drive change with the main overall goal to enhance the support and products.

Bennett and Rajlich developed a staged model of software life cycle [30][31]. In this model, software life cycle is presented as a sequence of stages. The key contribution of the model is that software maintenance (considered any work after initial delivery [30]) is divided in three stages: evolution, servicing and phase out. In software evolution stage occur iterative changes, modifications and deletions of functionalities. In servicing stage, changes are difficult and expensive, and therefore software is aging and decayed. In phase out stage, the support for software stops and it becomes increasingly outdated.

4. SOFTWARE MAINTENANCE CONCEPTS

Software maintenance relates to modifications of software after initial delivery to customers. Software maintenance is defined as the process of modifying a software system or component after delivery to correct faults, improve performance or other attributes, or adapt to a changed environment [23]. The terms "change" and "modification" are commonly used in literature [20]. According to Bennett and Rajlich software maintenance is important because it consumes a large part of the overall life cycle costs, and the inability to change software quickly and reliably [15]. Building an understanding of what is actually happening in organization maintenance projects is essential for maintenance improvement [32]. Common maintenance tasks are [33]: correction of faults, improvement of the design, implementation of enhancements, construction of interfaces with other systems, adaptation of programs so that different hardware, software, system features, and telecommunications facilities can be used, migration of legacy software, and software retirement.

Observed in an organizational context, software maintenance has the following dimensions [33]:

- *Technical*: deals with methods and tools for solving common tasks (limited understanding, impact analysis, testing, maintainability), and
- *Organizational*: as a part of organization, software maintenance must follow defined policies and contracts (alignment with organizational objectives, staffing or maintenance personnel, process, organizational aspects, outsourcing [34]).

Standard for Software Engineering - Software Maintenance, ISO/IEC 14764 includes four maintenance categories [33]:

- *Corrective maintenance*: Reactive modification of a software product performed after delivery to correct discovered problems
- *Adaptive maintenance*: Modification of a software product performed after delivery to keep a software product usable in a changed or changing environment
- *Perfective maintenance*: Modification of a software product after delivery to improve performance or maintainability
- *Preventive maintenance*: Modification of a software product after delivery to detect and correct latent faults in the software product before they become effective faults

According to Pressman, generic software process comprises from the definition phase, development phase and support phase [35]. In support phase that deals with existing software products four types of change exists: correction, adaptation, enhancement, and prevention. These types of changes correspond to the four categories of maintenance defined in literature: corrective, adaptive, perfective and preventive [33][23][15][36].

In practice, software maintenance and operational support consume substantial hardware and software resources in the information systems environments. This is particularly important when there is a need to keep older versions of software systems running in changed environment (operating system platform, new versions of other software systems in the environment, upgraded hardware or communication infrastructure). Despite that, many software organizations do not have any defined processes for their software maintenance activities, and there is also currently a lack of specific, adaptable process improvement models for software maintenance [37]. April et al. stated that it is important to understand the scope of maintenance activities and the context in which software maintainers work on a daily basis in order to establish effective maintenance processes.

April et al. further proposed typical interfaces that can be met in software maintenance [37]. The first interface deals with customers and users of the software under maintenance. This interface is used to provide services to users or customers. In the context of e-government this interface is defined between ICT departments of government, that is responsible for IS system maintenance and IS users. These users can be employees in a government organization, people from other public organizations and citizens [10][27]. Typical services that can be provided in this interface are services for specifying maintenance requests for various components of IS [38][39].

The second interface that can be provided towards users is Help-Desk service as a centralized help facility to their users. This type of maintenance service is in literature classified as front-end support, or upfront maintenance [28]. The main focus of this service is to offer immediate help to customers in cases when the customers encounter problems. Kajko-Mattsson identified that dominant problems in front-end support are the complexity of applications, customer knowledge, and complexity of support organizations.

The third interface in software maintenance provides connection between software maintainers and software developers (developers context). If the same team is assigned to development and maintenance activities, this interface does not exist (which is common situation in many organizations). April et al. listed some of the key activities of maintenance personnel [37]:

- Development of transition strategies to replace existing software,
- Design of temporary or new interfaces to legacy software,
- Verification of business rules or assistance in understanding the data of existing legacy software, and
- Assistance in data migration and the cutover of new software.

The fourth interface for software maintenance is toward the maintenance context that is in charge to maintenance of hardware and network infrastructure (computer operations context) [37]. This context can also be the segment of the organization and in that case, this interface services are regulated by the organization policies. This context is assigned to support, and maintenance issues associated with the workstations, networks, and platforms. Activities performed in this context are backups, recovery, and systems administration. In e-government organizations usually exists some kind of ICT department (ICT technical service) that provides these types of services.

The last interface proposed by April et al. [37] for software maintenance addresses relationships with a growing number of suppliers, outsourcers and vendors (suppliers context). Information systems in e-government are complex systems composed of components originated from various suppliers, outsourcers and vendors. Therefore, this interface deserves a lot of attention in e-government organizations.

5. CONCLUSION

Change is inevitable in any system. In practice, change in one segment of a system will affect other segments of the system. This observation can be applied also to e-government systems that are implemented as complex socio-technological systems. In e-government IS any technological or organizational change affects software segment of the information system and vice verse. That practically means that any change has reflection on a software segment of e-government IS. Key challenges of software maintenance and evolution are understanding, managing and reducing costs and risks inherent in change [19]. Implemented maintenance and evolution strategies must be aligned with organizational objectives with the main goal to extend the life of software for as long as possible [33].

Based on the above observations, many challenges have been exposed to e-government regarding software maintenance and evolution. The first thing to think about is related to delegating responsibilities in maintenance activities. This means that government organizations must decide which strategy to adopt in choosing, developing and maintaining software. Usually, government organizations have ICT departments that can partially develop and later maintain software systems. This further implies that government organizations must decide which software to develop and maintain with own ICT team, and which software to buy. Further, this implies negotiation and discussions about service scope, objectives and priorities, budgeting/pricing, and user satisfaction. The goal is to achieve a higher maturity level of

maintenance that can result in lower maintenance and support costs, shorter cycle time and intervals, increased ability to achieve service levels, and increased ability to meet quantifiable quality objectives [37].

Recommendations for future research consist of the following steps that can increase maintenance maturity level of government organizations. The first step is analysis of the current change management and software maintenance practice in e-government. Process assessment can help organizations to improve themselves by identifying their critical problems and establishing improvement priorities. Process assessment and improvement is based on collecting information about current state of the practice, defining what should be changed, and establishing goals and steps in pursuing improvements [40]. Success in the implementation of process improvement is measured by comparing the results before and after the introduction of improvements. That requires process monitoring and collecting data for an appropriate period of time. Therefore, during the implementation of process improvements, it is necessary to develop appropriate metrics that will ensure measurement of all relevant characteristics of improved process [41]. As the final goals are imposed improved reliability and availability of e-government services, increased satisfaction of users [10] and reduced costs and risks.

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Telemedicine – Model for low cost real time teleultrasound exam

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Abstract: **Telemedicine is a rapidly developing application of clinical medicine where medical information is transferred for the purpose of consulting, and sometimes remote medical procedures or examinations. In this paper we tested feasibility of the low-cost teleultrasound model for developmental dysplasia of the hip (DDH) exam in variety of network settings and computer configurations. Software applications were specially developed at Dartmouth College, Hanover, USA. The software applications enables:**

1. **direct monitoring of ultrasound exam in real time via teleconferencing module that in addition to audio link transmits ultrasound video stream,**
2. **recording and review of still ultrasound images, similar to functions available on ultrasound machine,**
3. **remote saving of ultrasound imaging - a function that saves images on local and remote computer and thus enables direct comparison of images by personnel on both locations,**
4. **ability to add additional text to images.**

Hardware and software solutions used for teleultrasound screening showed good characteristics for ultrasound image transmission in real-time.

1. INTRODUCTION

There are numerous studies in which the progress of information-communication technologies is used to improve the quality of health care [1] [2].

Telemedicine holds important place and has wider use in health care practice and improvement of health organization, above all providing the opportunity for standard and innovative procedures to combine [3] [4].

Transmission of still images and cross-sectional data has been widely used in both developed and developing world [5].

However, we focused on utilization of ultrasound and transmission of ultrasound image and video data. Reasons for this are twofold, the unique features of ultrasound and technological challenge of ultrasound data transmission.

Low-cost, availability of portable ultrasound units, safety features all enable its easy integration into both primary care and secondary care settings in developed as well as in the developing world. Two consequences, immensely important for the medical field are the educational potential and opportunities for public service [6].

Here, we tested feasibility of the low-cost teleultrasound system for DDH exam.

2. AIMS OF THE STUDY

Selection of technical solutions for the transmission of ultrasound images, testing hardware and software components of the model and applying the model of teleultrasound screening for DDH - in real time, via the Internet of low bandwidth connections.

3. MATERIAL AND METHODS

In the initial phase of this research, we tested software solutions and hardware configuration of the low-cost teleultrasound system for DDH exam, in four settings:

1. Local area network (LAN) with connection speed of UL/DL: 100 Mbps,
2. Metropolitan Area Network (MAN) within one internet service provider with connection speed UL/DL: 2000/2000 Kbps,
3. Wide Area Network (WAN) with connection speed UL/DL: 512/64 Kbps,
4. Wide Area Network (WAN) for trans-atlantic teleultrasound with connection speed UL/DL: 3358/863 Kbps.

A variety of computer configurations tested for transmission of ultrasound images included 2 to 3 GHz Pentium 3 and Pentium 4 processors, operative memory from 256 MB to 3GB and multiple graphics cards. All computer configurations were running on Windows XP OS.

All imaging was done with a portable ultrasound unit donated by Dartmouth-Hitchcock Medical Center (Lebanon, NH), USA and utilized in General Hospital “Djordje Joanovic”, Zrenjanin, Serbia.

Ultrasound image was transmitted to the computer via a Pinnacle PCTV Analog USB TV tuner video capture card.

We tested two software platforms capable of transmitting real time ultrasound images as well as supporting audio communication (Remote Ultrasound and Skype) in teleconference setting.

Both of them were developed at Dartmouth College, Hanover, USA and these unique applications enabled us to use ultrasound in the settings of limited resources [7] [8].

Figure 1 depicts software screen interface for first application based on open source libraries and standard video conferencing protocols available in Microsoft Research Group and operates under Windows XP and .NET environment [9].

First software application was used for transmission of ultrasound image via low bandwidth internet links between Serbia and the United States (Philadelphia, PA) during the ultrasound hip examination of 50 babies.

Figure 2 depicts software screen interface for second application is based on Qt programs environment and VLC multimedia libraries. Both components hold for cross-platforms and open source [10].

Second software application has been tested under laboratory conditions within Department for quality and scientific-educational researches of General hospital "Djordje Joanovic". During the testing there were 280 tests carried out with different codec and the values of Bandwidth and Framerate.

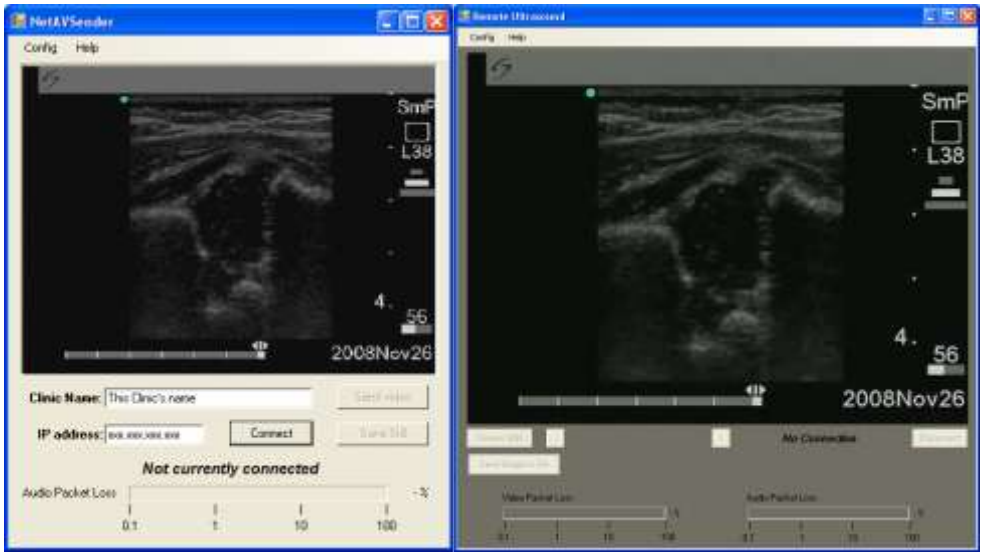

Figure 1. Software screen interface for firs application

A, NetAVSender: the transmitting interface B, Remote Site: the receiving interface.

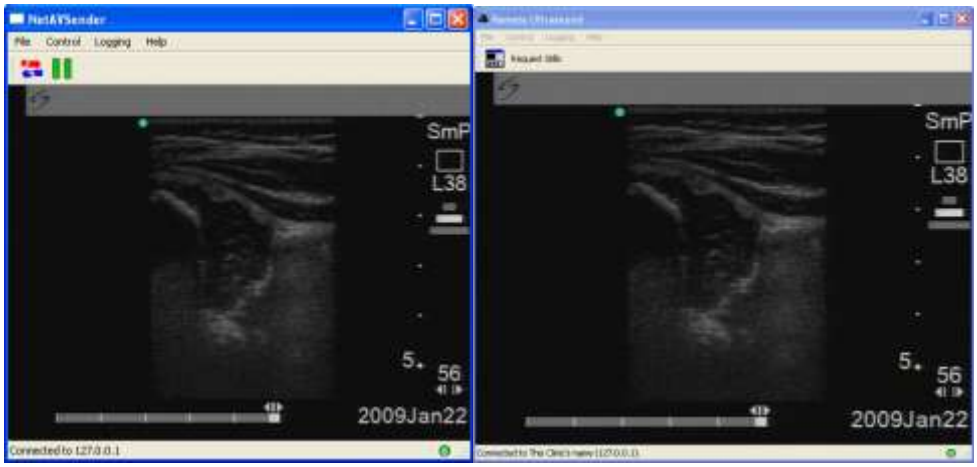

Figure 2. Software screen interface for second application

A, NetAVSender: the transmitting interface B, Remote Site: the receiving interface.

4. RESULTS

Final hardware platform used in all teleultrasound screening sessions was a notebook MSI EX610X-082EU, with AMD Athlon 64x2 TK55 chip, DDRII 3Gb, ATI HD2400, running MS Windows XP with Service pack 2.

Both software applications enable:

1. direct monitoring of ultrasound exam in real time via teleconferencing module that in addition to audio link transmits ultrasound video stream,
2. recording and review of still ultrasound images, similar to functions available on ultrasound machine,
3. remote saving of ultrasound imaging - a function that saves images on local and remote computer and thus enables direct comparison of images by personnel on both locations,
4. ability to add additional text to images.

The teleultrasound session was initiated by the sender who starts connection by adjusting the desired destination IP address.

In the first software solution IP address is entered in the IP address bar and connection is started by pressing the send button.

In second software solution destination IP address is registered in the Control menu options by selecting Connect and then it is possible to start the connection by pressing the button Connect to a Remote Server.

After about 2 second, the video stream appears on the receiver's computer and the exam is started.

Save function, in first application and Request Stills in second application of the Remote Ultrasound interface was used to record the still images while the ultrasound probe was moved or when the images were «frozen» on the ultrasound machines. Every time Save function or Request Stills is used, it records a dataset of images on sender's and receiver's computers.

First software solution used for teleultrasound screening hip of 50 babes showed good characteristics for ultrasound image transmission in real-time in environment of Internet UpLoad of 250 Kbps and (frame rate) with sample of 5 images per second through WMV9 coder.

During testing second software application we showed that the quality of transmission image and video is successful with the proper value of the parameter Framerate and Bandwidth for different types of used codec (*Table 1*).

Table 1. Minimal values of the parameters for the transmission of ultrasound images

Codec	*Bandwidth*	*Framerate*
WMW1	>224	≥3
WMW2	>160	≥3
DivX2	>224	≥3
DivX3	>160	≥3
H263 Theora Dirac	have not been satisfactory	

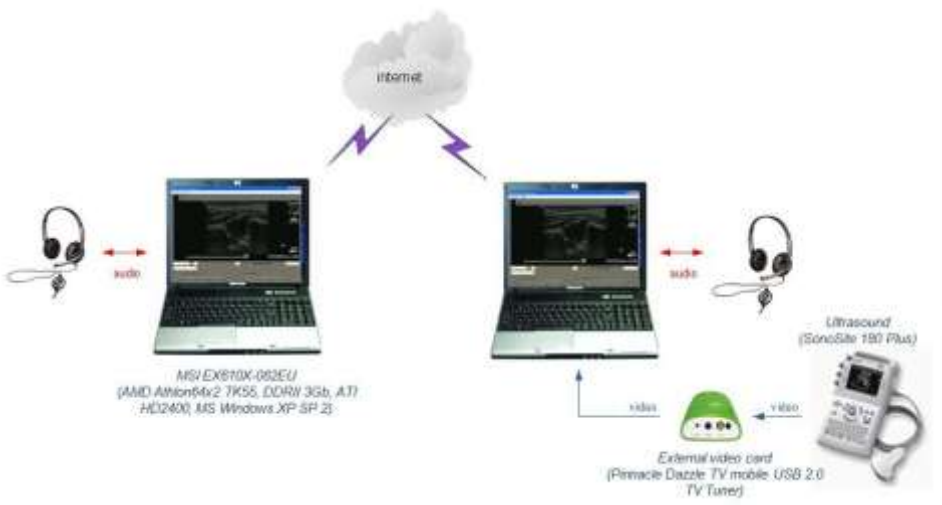

Figure 3. System Structure

5. DISCUSION

Nowadays, in rich and highly developed countries there is a capability of medical image transmission through highly sophisticated, specially purposed and expensive equipment, with great transmissive power of computer networks. This possibility is limited with the use of licensed and expensive software and equipment. In current situations of highly developed countries telemedicine is not practicable except in big medical centers, and beside that there is no simple and universal software for usage of telesonography. Therefore, communicational problems between developed countries are bigger, and the number of feasibility researches with low budget equipment is still unexplored.

One of the most popular standards in medicine is DICOM (Digital Imaging and Communications in Medicine). This Standard specifies the exact procedures under which the digital images are sent between devices, whether to use a network connection or a storage device. DICOM compression for still images uses JPEG format and for video uses MPEG-4 data format [11] [12]. Beside data compression, DICOM still requires a large bandwidth of computer networks.

Possibility of teleultrasound examination with limited technical resources on distance is practicable and clinically usable [7] [8].

The application of models for Teleultrasound screening of developmental dysplasia hip is not discussed in the scientific literature.

This research created a model for low cost real-time teleultrasound exam containing commercial equipment that is far cheaper than the sophisticated equipment intended to telemedicine. Portable Sonosite 180 used in this research is standard medical equipment for clinical practice and satisfies all current legal regulations and professional criterions.

Also, bandwidth computer network using sophisticated equipment is far greater than the bandwidth used by applying this model.

Both software solutions are based on open-source libraries and they showed good characteristics for ultrasound image transmission in real-time in the settings of limited resources.

Teleultrasound screening with limited resources provides access to these methods in the regions where health service is not highly developed and where there are no adequately trained medical professionals. In this way, health care practice is being improved and enables its integration into both primary care and secondary care settings.

6. CONCLUSION

Transmission of ultrasound data was accomplished with two software packages specifically designed for teleultrasound exams through internet connections of limited resources. Using this software applications, in conjunction with a hardware setup and low bandwidth internet link, we performed sonographic DDH exams in real-time. In addition, continuous monitoring of the exam via video stream, both software applications, offers remotely controlled recording and selection of still images on the sending and the receiving computer. Low cost model for teleultrasound examination is configured in this way.

During the testing, it was ascertained that hardware characteristics significantly affect the quality work of software applications and that it is important to provide adequate speed values of processor for its successful use, the size of RAM memory and graphic card, which is essential for sender (the computer which send ultrasound image on distance).

Model for low cost teleultrasound screening of DDH showed good characteristics for ultrasound image transmission in real-time.

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E-Government Development in Serbia - Trends and Challenges as Results of Usage of New Technologies

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Abstract: **New technologies, especially ones associated with the Internet, are driving the evolution of information exchange and service delivery in e-government. E-Government viewpoint is being shifted and user's needs are put in the centre of this movement. E-Government is becoming more oriented towards providing services on the user's needs, transparency and open public data. This paper provides an overview of modern trends and challenges facing e-Government introduction, implementation and modernization. In addition it gives comparison of the current state of e-Government in Serbia and EU (27+) and describes a new concept of e-Government known as e-Government 2.0.**

1. INTRODUCTION

The state of E-Government in Serbia has been measured for the last few years, both by independent and government institutions and by the Ministry [1]. Serbia has accomplished significant results and, year after year, the number of electronic services as well as their sophistication rises [2]. Although EU members are still ahead by level of rankings, it is expected that in the following years Serbia reaches the level of EU services' sophistication. Thinking ahead reaching this goal is advisable and the question "W*hat to do when services' sophistication reaches 100%?"* seems timely and reasonably. What should be measured and how should further e-Government development be seen are the main questions that will be addressed in this paper. We will present an overview of new trends in e-Government assessment, regarding methodology for estimating the state of e-government and technology development, and propose basic directions of further development of e-services accordingly.

The role of modern technologies in e-Government development is very important. In order to enable communication on more integrated and more efficient level with citizens and legal entities e-Government needs to be in step with current technological trends. Citizens are expecting better services, secured services and participation in democracy, while businesses expect to gain less bureaucracy and more efficiency. Web 2.0 technologies and applications can help e-Government in achieving those expectations, and in this process constant improvement of developmental strategy is expected. Developmental strategy of e-Government has to be flexible enough to adjust to constant technological progress. This further means that future development of e-Government is much broader issue that does not only include current state analyzes, but also long-term analyzes and consideration of technological state far in advance as well as prediction of types of services that will be required.

As a result of new technologies adoption, methods for measuring e-Government progress are being reevaluated, target features are being refocused and, in general, approach to further e-Government development is changing. Keeping up with such changes is certainly difficult, but necessary for modernization of e-Government and more efficient interaction with users. This implies creation of a unique market of user oriented e-services.

In Europe the time has come for results summarization regarding the i2010 e-Government Action Plan [3]. i2010 objectives have been evaluated over the years. The supply of online public services was measured as a key enabler for delivering the Action plan and Lisbon goals. For final measurements, however, e-government benchmark is changing. The high impact services and user experience are newly introduced benchmark indicators.

New digital agenda of EU [3], which is currently under development, is putting users in the center of action plan for digital economy – i2015. Accordingly to the newest benchmark for i2015 [3], general recommendation for the upcoming period is improvement of services in the fields of health and education, as well as more intense development of local e-governments.

2. BENCHMARKING E-GOVERNMENT IN EU(27+)

Benchmarking e-government is a very important task. It indicates the progress in reaching e-government goals and can be used as a tool for learning, information sharing, goal setting or supporting performance management [4].

The European Commission's "e-Government Benchmark" (EUeGovBe), together with the UN's "e-Government survey" and West's "Global eGovernment report", belongs to the longest running efforts to track the development of e-Government [5]. Since its inception in 2001, EUeGovBe has proven to be a policy accelerator among the EU Member States and beyond [6]. It is applied on the yearly basis in order to provide review of basic public services and e-government progress in terms of core indicators. Over time, the EUeGovBe core indicators have changed, since it was necessary to create a dynamic measurement instrument that will retain the existing comparability and the principle of open collaboration with participating countries [7]. From the time when the seventh measurement was taken, back in 2007 EUeGovBe has experienced a major enhancement in measuring criteria and core indicators. In 2007 EUeGovBe benchmark consisted of a set of four indicators [8]: sophistication, availability of services, user orientation and national portal. In 2009. EU Member States and the European Commission decided that the benchmark had to move away from the its original supply-side focus. New benchmark focus is put on the on high impact service areas as well as on the usage side of e-Government which was neglected in the previous measurements. Two of the core indicators: national portal and user-centricity are removed and instead e-Procurement and User experience have been added, reflecting a shift in policy priorities towards outcomes and impact.

The 8th EUeGovBe measurement results [7] show that sophistication of services reached 83%, and that the total services availability is 71%. This results classify EU(27+) at the top of the transactional e-Government levels[7]. The average value of e-Procurement availability is 56%. The best results were accomplished in Estonia (100%), Ireland (100%), Luxembourg (98%) and Malta (92%). More than eight countries have results above measured average. Large group of countries have results between 40% and 60%, while only eight are below 40%. Iceland has the lowest average - 15%. When comes to the user experience, the study results vary between 34% and 81%. The best results are achieved in Finland, Great Britain, Malta, Estonia, Spain, but there are good practice examples all over Europe.

3. STATE OF E-GOVERNMENT IN SERBIA

Serbia is one of the many countries of the Balkan region that had a late start in e-Government. The first e-Government dedicated strategy was introduced in 2009. and since then considerable efforts have been made in order to offset the gap in e-Government development compared to the rest of Europe.

New e-government portal [9] began working in 2010 and it now integrates all existing services on local and state level that are offered to citizens and legal entities. Large number of municipalities in Serbia offer online services to citizens [10] such as: ordering birth certificates, ask the president, reporting utility issues, checking voter's list, etc. On the state level there are e-services for legal entities such as reporting taxes for large taxpayers, e-public procurements, applying employees for health insurance, submitting request for registering medical device in the Registry of medical devices, submitting request for electronic submission of customs declarations etc., as well as services for citizens: reporting crime acts, getting information about a location, request for issuing a building permit, service for issuing identity cards, request for issuing certificate of change of street name, certificate of residence, request for registering in/deleting from/changing voters list, request for issuing assurance from voting list and many others.

The first unofficial e-Government benchmark dates from 2004[11]. However, only when the first official benchmark was performed, in 2008[2], it started to be seen as a very important progress indicator and policy accelerator.

The e-Government progress in Serbia has been measured for the past six years by independent institutions, government organizations and the Ministry. For that period e-services sophistication has been significantly improved. From 15.24%, which was the value of sophistication in 2004 [11], sophistication has reached 51% in 2009 [12]. Sophistication ranges from 100% (Malta, Portugal, Sweden, Austria, Slovenia and Estonia) to 56% (Croatia). Compared with Europe in terms of services sophistication, we are way behind, namely at the last place, right behind Croatia. In terms of services availability we have also lost the battle, but when comes to the service e-Procurement we could be worthy competitors. In Serbia, Government for public procurements, through Web portal for public procurements [13], enables publishing, tracking and searching of public procurements as well as reviewing of tender documentation. This portal is ranked with stage 3 of maximum four stages of development (75% sophistication) when applying older EUeGovBe methodology [12]. Therefore we cannot directly compare this service sophistication with e-procurement service implementation and availability indicators of new EUeGovBe methodology [7]. Nevertheless we can say that if new methodology has been used in terms of evaluation of this service Serbia would be concurrent with the rest of the Europe.

Usage side of e-government is considered as a important, yet neglected, progress indicator [4]. This indicator hasn't been used in official e-government studies but we believe that is very important for Government to pay attention to how much e-Government services are really used.

According to the Statistical Office of the Republic of Serbia on the matter of usage of information and communication technologies in Serbia in 2010 year [14], among households and individuals that have access to the Internet, which is 39% of households in 2010, 13.2% of them are using e-Government services, while 48.3% of them are interested in that option but are currently not using them. That means that over 325 000 people use e-Government services,

which is slightly over 40 000 more than the last year. Considering that e-Government services exist in Serbia for just a few years, we can say that percentage of usage of those services matches the number of years of their existence. When asked for what they use the Internet, most of households (78%) answered for sending electronic mail, which is understandable considering the fact that e-mail is one of the oldest internet services. When comes to the younger generations, as future users of e-Government services, we can analyze the results of a survey conducted by Microsoft in 2006. Survey was realized as part of an international project "Partner in learning" [15] that started in 2004 with the support of Government of Republic of Serbia. Purpose of the project was to establish level of competence and interests of pupils for appliance of information and communication technologies in learning process. The survey involved 1387 pupils from 14 schools in Serbia. Interviews were conducted with pupils from higher grades in elementary schools and pupils from second, third and fourth grade in high schools. The results of a survey [16] show that most pupils (96.20%) use a computer in school, mostly for informatics and computers classes (65.40%), educational computer programs (20.60%) and internet researches as part of learning process (17.52%). Interviewed pupils also have access to computers at home (81.30%). Large number of pupils (70.74%) claimed to have confidence in computers and information technologies, which shows that younger generations can easily adapt to new technologies. Based on the survey data, we can conclude that younger generations, as future users of e-services, will be much more active due to faster acceptance and adaptation to new technologies.

In the upcoming period it is needed to devote attention to increasing number of e-services users. One way of achieving this goal is active campaign and promotion of e-services and this process can certainly be facilitated by new types of applications and tools brought by Web 2.0.

4. WEB 2.0 AS A TOOL FOR PROMOTING E-GOVERNMENT AND E-SERVICES

The Web 2.0 is an umbrella term encompassing new technologies, applications and concepts on Web [17]. Web is transforming into a platform that enables users to participate in creating and shaping its content rather than being just passive observers [18]. Concepts, such as interactive information sharing, interoperability, user orientation and collaborative work, have led to creating tools and applications, like blog, wiki, RSS, social networks, video networks, that enable average user to create, publish and change content on Web. This new concept are easily accepted by younger and middle age population. People like to be virtually present on the web, and the following fact testify this statement: over 100.000 video clips are published on a YouTube on daily bases [19]; Wikipedia hosts approximately 16 million articles written in 270 languages [20]; Facebook has over 500 million active users [21].

Governments can use Web 2.0 framework in order to provide better e-services, improve communication with users and provide active participation of users in e-Government. One way to achieve better communication with citizens, and at the same time increase number of e-services users, is using social networks. Social networks can improve availability of information to citizens, involve citizens in decision making and enable delivery of services focused on citizens' needs. While this way of communication with citizens is long present in Europe, the Ministry of internal affairs is the only ministry in Serbia that communicates with citizens through social networks [22]. On the Ministry of internal affairs official Web site [23]

there are links to their profile on YouTube, Facebook and Twitter. Their Facebook profile is very popular. Through this profile citizens can ask questions, review news related to current laws or leave criticisms or remarks on their work. The Youtube page of the Ministry of internal affairs publishes video clips, while through their Twitter profile citizens can be informed about latest news.

5. E-GOVERNMENT 2.0

Web technologies development affects the development and transformation of e-Government. New e-Government concept is being created, known as e-Government 2.0, which redefines e-Government as platform for active citizens participation [24]. Some features of this new concept are: focus on citizens' needs, transparent government, active users involvement, users as innovations initiators, services on users needs, data and transaction safety, integrated services, trust in services and collaboration of state services in data interchange. We believe that transparency is one of the most important feature of e-Gov 2.0. Transparency indicates opening government to users to the extent that users can track government's activities, affect irregularities in published data and stimulate innovations [25]. According to [24], transparency should be a new flagship goal in e-Government 2.0.

New e-Government concept does not imply leaving the old one, it should be understood as concept that will be embraced once the goals of "e-Government 1.0" are achieved. EU(27+) Member Countries are near accomplishing 100% of sophistication and services availability [7], and the initiatives for e-Gov 2.0 benchmark are rising rapidly. E-Government 1.0 benchmark focuses on 20 basic public services. This benchmark used 4 core indicators: sophistication, availability, user centricity and national portal. These indicators are considered as oriented toward supply-side of e-Government and usage side indicators are missing from the benchmark. This is why EUeGovBe is being forwarded to meet the outcome and impact of e-Government. David Osimo, proposes in [24] that e-Government 2.0 focus should be put on 20 basic public data. Public data set is something that yet needs to be define. Accordingly to [24], public data set could include laws drafts, pollution data, data on MP's voting, surveys results etc. Core indicators of e-Government 2.0 progress, as suggested in [24] are to be data availability and reusability, instead of sophistication and services availability that were used in e-Government 1.0. In EU, there are initiatives for evaluation of specific public data such as Open Budget Index [26] or the Transparency league table of Farmsubsid [27].

These initiatives serve as good examples, but their criteria are related to specific data. For this research, more useful are initiatives for indicators that can be generally applied to all public data. In USA there is a working group that strives for open government and this group gave basic principles for evaluation of public data [28]. Principles overview and their meanings are shown in Table 1. These principles should serve as the ultimate goal towards which should e-Government 2.0 data strive, in the same way as services in e-Government 1.0 strived towards complete availability and sophistication.

David Osimo [24] recommends using 5 levels scale for evaluation of public data in e-Government 2.0. His scale reflects to what extent public data is available on the web. Levels overview is given in Table 2, they gradually strive from no data to sheer data availability and reusability.

Table 1. Public data principles in open government

Principle	Meaning
Complete	All public data is made available. Public data is data that is not subject to valid privacy, security or privilege limitations.
Primary	Data is as collected at the source, with the highest possible level of granularity, not in aggregate or modified forms.
Timely	Data is made available as quickly as necessary to preserve the value of the data.
Accessible	Data is available to the widest range of users for the widest range of purposes.
Machine processable	Data is reasonably structured to allow automated processing.
Non-discriminatory	Data is available to anyone, with no requirement of registration.
Non-proprietary	Data is available in a format over which no entity has exclusive control.
Licence-free	Data is not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed.

Table 2. Availability of public data in e-Government 2.0

Level	Meaning
0	No information available
1	Description of the procedure to obtain the information through FOI
2	Information available in non reusable, non-machine readable format
3	Information available in reusable and machine readable format such as xml or dbase
4	Information available as per stage 3 and visualizable through predefined tools (georeferencing, hystogram etc)

6. PUBLIC DATA MANAGEMENT PLATFORM

Opening public government towards citizens is one of the major goals recognized all over the world. The essence of this goal is data openness, data availability and format that enables their understandability and reusability. The solution that is accepted by USA Government and that is widely used for public data presentations is platform Socrata [29]. This is commercial platform that enables searching, sharing and reusability of public data. Users can use tools for data filtering, visualization, tracking data changes, conducting data discussions, exporting data in appropriate format (PDF, RDF, XML, XLS, CVS,…) or programmatically download data in OpenAPI format.

Socrata or some other similar platform can be used by Serbian Government in order to provide public data visualization and sharing. Prior to that public data must be clearly defined

and available. One example where such platform can be applied is for sharing statistical data. Statistical data, published by Statistical Office of the Republic of Serbia, are currently only available in non-reusable format (PDF). It would be of great importance to those who use these data for different analyses to have statistical data available in machine-readable or reusable format. In that way they would not have to copy data from PDF documents and then format them in accordance with their needs.

The examination of available call centers has led us to the conclusion that their functionality is quite complete. But unfortunately, from further insight we have concluded that only a few commercial call centers support mechanisms like API libraries and scripting in order to extend the functionality of the basic product. At the same time, virtual call center implementations using an open source IP Personal Branch Exchange do not support such complete functionality but are more easily and efficiently extendable and adaptable to different call center's requirements.

7. CONCLUSION

Based on previous studies of E-Government [1] [9], it can be concluded that e-Government in Serbia has made an important improvement. In 2009 Serbia was on half way to accomplish 100% of services sophistication and generally to achieve e-Government 1.0 goals: 20 public services to be implemented and to function as much as possible. Now we should think about new e-Government concept, e-Government 2.0, and concepts brought by it, among which the most important are transparent government and open and reusable data. Sharing public data and opening government towards users is extremely important because they lead towards development of completely new services.

E-Government cannot exist by itself, for itself or for achieving 100% of sophistication and services availability. It has to affect citizens in a way that they use services intended for them. E-Government has to be there where the citizens are and to enable citizens to become active participants in e-Government and not just observers.

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Goals and Recommendations of Digital Agenda EU 2010 in the Area of E-Government

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Abstract: **In March 2010, European commission presented the Europe 2020 Strategy. Digital agenda for Europe is one of the seven initiatives of Europe 2020 Strategy, which defines the key role of Information and Communication Technology (ICT) usage in order to successfully achieve Europe's 2020 ambitions. This paper describes general goals of Digital agenda and also goals and recommendations which refer to e-Government. Special attention is given to the problems of interoperability, digital cooperation and economies of border countries and also e-Identification and e-Authentication. The conclusion presents the elements of Action plan which should be used for European union country members to develop national plans, and may serve as a recommendation for developing countries and EU candidates.**

1. INTRODUCTION

Digital agenda for Europe is one of the seven initiatives of Europe 2020 Strategy, which defines the key role of Information and Communication Technology (ICT) usage in order to successfully achieve Europe's 2020 ambitions.

More than ever, Europe needs new, clear, balanced Digital agenda based on complete understanding of political issues and their contexts. Pragmatic strategy is basis for sustainable development and growth in order to Europe be able to face with these main challenges:

- European transformation into highly professional economy with high level of employment and economy that is needed in global surrounding;
- Problem solving of elders, at the same time with improvement of main public services;
- Infrastructural problem solving with consideration of predictable extension and environmental constraints.

2. GENERAL OBJECTIVES OF AGENDA AND CONSTRAINTS FOR ITS IMPLEMENTATION

Main Agenda's objective is to make a path for maximum usage of ICT's social and economic potential, primarily using internet for fun, communication, work and free research. Successfully accomplishment of Agenda will enable innovations, economical growth and improvement of everyday's life both for citizens and businesses. Wide and more effective usage of digital technology will help Europe to focus on key challenges and provide better quality of life for Europeans.

Based on consulting with stakeholders and based on Grenada Declaration and European Parliament Resolution insight, European commission identified seven most important obstacles. Individually, and in combination with each other, these obstacles significantly weaken efforts for ICT exploitation. They stressed the necessity of overall and united political answer at European level.

- Fragmented digital market

Europe is still made of national on-line markets and therefore Europeans cannot enjoy unique digital market benefits. Commercial and cultural content and services must flow regardless the borders, which can be accomplished by eliminating of regulatory barriers and simplifying e-payment and billing. Further efforts must be made in existing regulatory frame to interweave unique market in Telkom sector.

- Lack of interoperability

Europe still do not collect maximal welfare of interoperability. Disadvantages in standardization, public procurement and coordination between authorities prevent digital services and equipment which are used by Europeans and restrain them to work together as they should do in the first place. If different parts and applications are interoperable and based on standards and open platforms, Digital agenda can be initiated.

- Lack of network investments

Activities must be focused on giving right incentives for stimulating private investments, supplemented with carefully chosen public investments, without network monopoly and with improved distribution specter, too.

- Insufficiency of research and innovations efforts

Researches talent must be improved in order to provide innovative ecosystem, where European oriented ICT companies of all kinds can develop world class products to generate demand. Therefore, suboptimal character of today's researches, aligned innovative effort of many private investments, better coordinating and synergy of resources, better and faster digital access to small and medium sized enterprises, must be directed to European research funds. Research infrastructure and innovative clusters must be joined together with standard development and open platforms for new applications and services, too.

- Lack of digital literacy and skills

Europe suffers from the lack of professional ICT skills and digital literacy. These disadvantages exclude most citizens from digital community and economy and keep great multiplayer effect on ICT, that could be directed to productivity growth.

- Cybercrime growth and risk of network confidence decrease

Europe must be focused on cybercrime decreasing – from child abuse, to robbery and cyber attacks – and directed to appropriate defense mechanisms. Internet is critical information infrastructure for individuals as well as European economy in general, in that way IT systems and networks must be flexible and they must provide security from all threats.

3. DIGITAL AGENDA 2010 AND E-GOVERNMENT SECTOR

E-Government services provide cost effective path to better services to each citizen and business and are opened for participation in transparent government. E-Government services may reduce expenses and save time needed for public administration and businesses. It helps in decreasing risk of climate changes, natural and human caused disasters, by including data sharing about environment, too. Today, despite the high level of availability of e-Government services in Europe, there are still many differences between member states while the usage of e-Government services is still low. In 2009 only 38% Europeans used Internet to access e-Government services, comparing to 72% of those who used Internet for business purposes.

European authorities advocate for making better personalized multiplatform e-Government services focused on the user until 2015. Until then, authorities should take measures to avoid unnecessary technical requests, e.g., applications that can operate only in specific technical environment or with specific equipment. The Commission will be an example of smart e-Government implementation. These services will support administrative processes, ease information sharing, and simplifying interactions with the Commission, by encouraging users and improving efficiency, effectiveness and transparency of the Commission.

Most public on-line services do not work across borders at the expense of mobility of citizens and businesses. So far, state authorities have focused on national needs and have not sufficiently taken into account the dimension of the single market of e-Government. Only a few of the single market initiatives and legal instruments (such as the Services Directive or the e-Procurement Action Plan) rely on the ability of business to interact and operate with public administration across borders electronically.

Therefore, Europe needs a better administrative corporation for better development of public online services across borders. This includes the implementation of e-Procurement as a practical e-identification and e-authentication services across borders (including mutual recognition of security levels for authentication).

E-Services Environment, as a category of e-Government services, are either undeveloped or scattered across national boundaries. Community law in this area should be re-examined and modernized. Also, innovative solutions such as advanced sensor network, can fill the gap in necessary data. Commission's activities in the future include:

- To make propositions until 2012: Decisions of the Council and Parliament to ensure a common recognition of e-identification and e-authentication through the EU online based on "authentication services" and offer it to all Member States (which can use the most appropriate civil official document – issued by public or private sectors);
- To support cross border e-Government services in the single market through the Competitiveness and Innovation Programme (CIP) and Interoperable Solutions Programme for the European Public Administration (ISA);
- Revise to 2011. Public Access to Environmental Information Directive;
- To work with Member States and stakeholders to implement cross border e-Environment services, especially in advanced sensor networks;
- To define concrete steps in the White Paper in order to bring together e-procurement capacity across the single market until 2011;

- Led by the example of an open and transparent e-Government, to implement an ambitious e-Commission action plan (2011-2015), including full electronic procurement;
- To make fully interoperable e-Government services, to overcome organizational, technical or semantic barriers and to support IPv6;
- To improve interoperability through coordination – A key activity for promoting interoperability between the state administration will be possible when the Commission accepts an ambitious European Interoperability Strategy and the European Interoperability Framework which will be part of the ISA program (Interoperability Solutions for European Public Administrations) [3].

The Commission will examine the feasibility of measures that can direct significant market players to licensed interoperable information, and at the same time, will promote innovation and competition. As part of the review of EU policy of standardization, the activity of the Commission will be to propose legal measures for ICT interoperability in 2010, to reform the rules for the implementation of ICT standards in Europe, in order to allow the use of ICT Standards Board and the consortium.

4. SUSTAINABLE HEALTH CARE AND ICT BASED SUPPORT FOR A DIGNIFIED AND INDEPENDENT LIFE

The development of e-Health technology in Europe can improve the quality of care, reduce medical costs and encourage independent living, including remote areas. A necessary condition for success is that this technology includes the individual's right to have personal health information securely stored within the health system available online. In order to exploit the full potential of new e-Health services, the EU should remove legal and organizational barriers, especially those related to pan-European interoperability, and to strengthen cooperation between member states.

E-Health Lead Market Initiative will promote standardization, interoperability testing and certification of electronic health records and equipment. New services such as telemedicine, online medical consultations, improved emergency care and portable devices that allow monitoring the health status of people suffering from chronic illness and disability, will have the potential to provide freedom of movement that patients had not been able to fully experience.

Ambient Assisted Living (AAL) technologies put ICT available to everyone. EU-dedicated AAL Joint Programme with Member States in connection with advanced research and applications such as telecare and online support for social services will be strengthened: to cover the certification of career (i.e., those that provide interface information service for people who would otherwise have difficulties using the Internet); and to establish new ways to put ICT at the service of the most vulnerable members of society. This program will ensure that the digital society allow more independent and dignified life for people who are weak or suffering from chronic illness and disability. AAL will promote innovation and development of ICT solutions in key areas such as prevention of falling (which affects more than one third of people over 65) and support for people suffering from dementia (affecting more than 7 million people in the EU), with the aim of improving independent living for seniors by 2015.

Commission's activities in this sector will be:

- To make a project “Europeans with secure online access to their medical information” until 2015, and to achieve a wide development of telemedicine services until 2020;
- To define recommendations for common minimum data set of patients in order to improve interoperability of patient records so they can be accessed or exchanged electronically through the Member States until 2012;
- To encourage the EU standards, interoperability testing and certification of e-Health systems through dialogue between stakeholders until by 2015;
- To strengthen Ambient Assisted Living (AAL) Joint Programme in order to allow older people and people with disabilities to live independently and to be active in society.

5. CONCLUSION

The challenge of creating New digital agenda requires an effective Partnership agreement between all stakeholders (government, universities, companies, civil society) in order to build the right strategy of confidence in the implementation of various laws. Focus on Innovation and Knowledge, as drivers added value creation with the international prevalence, is the unique challenge that may be the answer to a new way of interaction between those who have the responsibility of thinking and those who are responsible for the production of goods and services. In the New global innovative society, New digital agenda has a central role for the permanent satisfaction with value creation and focus on creativity.

Effective use of New digital agenda in Europe requires the Action Plan focuses on the following priorities:

- Innovative economy - driving the future prosperity;
- Knowledge society - all involved;
- Green ICT - support eco-efficient economy;
- Next-generation infrastructure: balancing investments with competitors;
- Soft infrastructure: investment in social capital;
- SMEs and ICT - support for European small businesses;
- Single market information - enables the connection and growth;
- The transformation of e-government - the restructuring of the public service;
- Trust in the online system - safe and secure digital world;
- Clear leadership - the restructuring of European law making process.

In the time of changes, New digital agenda cannot wait. Implementation of the digital agenda and Action plan at national level is an important step for developing countries and candidates for the EU and the faster adoption of European standards and strengthening the economy.

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