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Article · September 2006

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M-GOV: The Evolution Method

Ljupco Antovski, Marjan Gusev

Institute of Informatics, Faculty of Science, University Ss. Cyril and Methodius
Arhimedova b.b, 1000 Skopje, Macedonia
e-mail: anto@ii.edu.mk, marjan@on.net.mk web page: http://stella.ii.edu.mk/mgov

Abstract : *The current state of the art in e-government and m-government inMacedonia is presented in the first part of the paper. The second part concentrates on the M-GOV platform. The M-GOV (Mobile Services for Government) project is a research and innovation project at the Institute of Informatics in Skopje, designed to encourage the access to new mobile and wireless public electronic services. As a common mobile public services framework, it incorporates the following five principles: Interoperability, Security, Openness, Flexibility and Scalability. It is a SOA (Service Oriented Architecture). The M-GOV architecture is formed of three major components: Citizens access devices, Service Discovery Directory and the Collection of public electronic services from various sources. The citizens can access the electronic public services from anywhere, anytime from any mobile Internet-connected device. Key points of innovative ideas and views for further research and development in this field are presented in the paper.*

Keywords: service discovery, mobility, ontology, SOA, service composition, mobile web services, electronic public services

1. Introduction

E-government in the information age gives rise to a new kind of relationship between citizens and the authorities. New means of communication and technologies offer users free and open access to the virtual world of public institutions. The public administration is shedding its bureaucratic character and is transforming into an efficient, service-orientated provider of services [4].

E-government gives citizens the chance to participate directly in opinion-forming and decision-making processes. Public discussion forums and Internet chat rooms can be used to intensify the dialogue between citizens and the bodies responsible for political decision-making. In the future, it will, in the virtual world, be easier to involve citizens in advance in the legislative process.

E-government 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). M-government is defined as the strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in e-government including citizens, businesses and all government units [9].

The main point in favour of m-government is the fact that mobile phone's penetration is reaching an 83% rate surpassing fixed telephony subscriptions in Europe [12]. It means that innovative and radical services applied through mobile technology may significantly improve the operations and communication efficiency of governments. Such innovative service is to extend public administrative transactions in ways that actively involve citizens allowing them to communicate and collaborate with public administration systems through their mobile devices in a transparent and trusted environment.

2. E-Government in Macedonia

Even slowly, the things in the E-Government area in Macedonia are moving in the positive manner. The government has formed a commission for Information Technology. The commission in 2005 developed the national strategy for Information Society development and the implementation action plan [8].

The information systems in the Government and the ministries currently appear to be like isolated islands without a common basis that would link them. Parts of the Governmental institutions do not use local networks, and those that use it have special Internet connection. There is no computer network that connects the Governmental institutions, and there is a great part of systems that were inherited and are incompatible. This type of organization obstructs the efficient electronic data exchange between the Governmental institutions, apart from the e-mail usage, which is the only tool for electronic data exchange. The situation with the information systems in the local self-Government is at its minimum. Physical infrastructure exists in only a small part of the local self-Government. There is no possibility for any structural electronic data exchange between the Governmental institutions at the central and local level.

In order to remove possible problems and barriers in the e-Government implementation process, it is necessary to introduce a mechanism that would periodically measure the implementation level. The strategic measures that are proposed are:

- Citizen participation in the Information Society building- citizens have a key role in the information society building process, not only as services beneficiaries, but also as participants in the process;
- Infrastructure at a satisfactory level - in respect to the public administration (Government, state administration bodies and local self-Government units) requires conducting specific activities for ICT-infrastructure provision;
- Legal and institutional framework for Information Society development- The provision of a legal framework by adopting a Law on Information Society is the prerequisite for initiating the implementation of this Strategy;
- Logical infrastructure for advanced ICT-solutions and network connection between Governmental institutions - the State should always be a guarantor for the principles of information accessibility, free information flow between the public administration entities with continuous data updating and timely submission of information to other entities, according to previously defined and accepted standards;
- Electronic transactions for e-Government services that encourage economic and social prosperity - The e-Government electronic transactions are offered by the Government, state administration bodies and the local self-Government units. This concept upholds the traditional methods of service provision, and it also establishes new channels through which the citizens, the business community and the other organizations will be served with faster, secure and more accessible services and information. New channels are identified through: call-centers, web-portals, one-stop shops, mobile devices, digital television, which must be integrated, web-technologies based.

The government of Macedonia since December 2005 with the strategic partnership with Microsoft has developed several E-Government services. The services in the beginning will be portal oriented but are foreseen to become interactive and transaction oriented. The developed services are:

- www.uslugi.gov.mk – standardized informational portal for the citizens of Macedonia for information concerning the ministries and agencies
- www.emarketplace.org.mk – Internet presentation for small and medium size enterprises
- gs.gov.mk – Internal portal of the general secretary of the government.

Another interesting project is implemented in the procurements in the local self-government at regional level. The procurements in several municipalities are conducted in electronic way. There in also a possibility for applying for open positions in the public sector as public servants over the Internet.

Even though the E-Government is in the infancy, in May 2006 the first M-Government service has appeared. The citizens can check the personal information in the election list and the place where they are supposed to vote on the Election Day. The service is specially prepared for the parliamentary elections in 2006. The service can be accesses over Internet, SMS messages or call center [11].

2.1. The Public opinion

The authors conducted an electronic survey of the citizen's opinion in order to gain a solid understanding of the user's readiness to adopt the m-government channels [2]. Macedonia is candidate country of the EU with medium IT penetration and strong penetration of mobile and wireless technologies. The fact that there are more than 800.000 mobile phone users (>40%) and the number of Internet users is slightly above 100.000 (>5%) is substantial to conclude that in order to bridge the digital divide, the m-government strategy is must for a developing European country. The critical number (>35%) is reached and the technology infrastructure exists.

Benefit	**% participants**
Better Information	41%
Save time	33%
Better communication	29%
Freedom	23%
Mobility	21%
Democracy	21%
Transparency	16%

Table 1. Survey-Benefits from M-Government in Macedonia

The electronic survey was anonymous. The survey was intended mainly for the employees and the student at the Institute of Informatics in Skopje. Total of 101 participants answered the questions in the survey, 63% males and 37% females. The participants were mainly young people, in the age group 20-35 years old with strong IT knowledge.

According to the results, the major part of the participants were not informed about e-government (66%) and even more 68% did not have a clear picture what is m-government. From the rest, 55% saw m-government as an addition to e-government and 45% considered them completely diverse.

The participants numbered several issues as benefits from implementing m-government services in Macedonia. The mostly addressed issues are presented in Table 1. When it comes to the State's strategy about implementing m-government services, the participants clearly identified that it should involve pilot projects, implementation of balanced services with democracy/cost and services that are profitable in nature.

The participants pointed out that the issues as: lack of knowledge in the government, lack of technical infrastructure, lack of initiative and inexistence of ministry of information technology should be considered as major obstacles when implementing m-government services in Macedonia.

3. Service Oriented Architecture

The Service-oriented architecture is believed to become the future e-government technology solution that promises the agility and flexibility the business users have been looking for by leveraging the integration process through composition of the services spanning multiple agencies [7]. SOA is an approach to loosely coupled, protocol independent, standards-based distributed computing where software resources available on the network are considered as Services.

The services in SOA have minimum amount of interdependencies. The communication infrastructure used within an SOA should be designed to be independent of the underlying protocol layer. It should offer coarse-grained business services, as opposed to fine-grained software-oriented function calls. It implements service granularity to provide effective composition, encapsulation and management of services. The key concepts SOA is based on are: Loose Coupling, Coarse Granularity and Asynchrony. Loosely coupled, coarse grained, asynchronous SOAs provide a layer of abstraction that hides the complexity of the underlying technical implementation details from the user who takes advantages of the Services the SOA exposes.

- Coarse Granularity – The traditional approach to getting information in and out of an application is via an application programming interface, or API. APIs are typically fine grained, which means that each method call is a detail-oriented, technical construct for use by programmers. For two systems to communicate a complex business task via an API, they typically must exchange many of these fine-grained messages. Web Services are at their most powerful when they are used to exchange coarse grained information between systems. Coarse granularity clearly depends on loose coupling, because the Web Service consumer does not care how the Web Service puts together the information it needs [6].

- Loose Coupling - traditional distributed computing architectures is that they are tightly coupled, Making changes to one tightly coupled system often affects the whole architecture, requiring expensive and difficult reworking. SOA based on Web Services is loosely coupled. Each Web Service describes how other systems, known as Web Service consumers, can connect to it and exchange information with it. A developer can make changes to a Web Service without breaking the Service-oriented architecture.

- Asynchrony - synchronous communications consist of round-trip messages in which the sender waits for a reply. With an asynchronous message, the sender can submit a request, and then go about its work. If a reply does come, then the original sender can pick it up when it wants. Email works asynchronously, for example. Web Services based SOAs enable sending and receiving both synchronous and asynchronous messages.

In order to visualize SOA, one can use the SOA Meta-model, represented on Figure 1 [5].

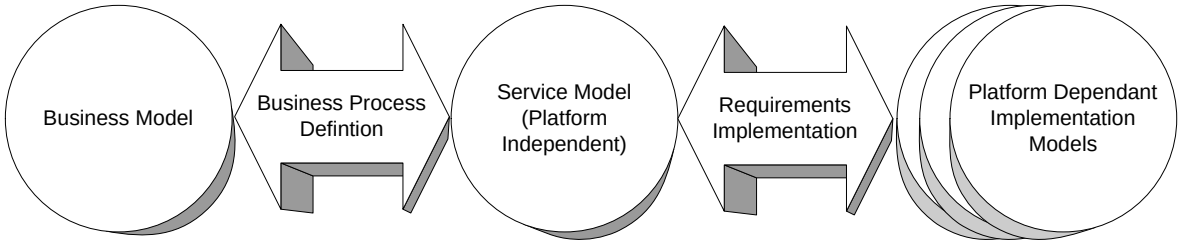

Figure 1 SOA Meta-model

The basic of the SOA Meta-model is the Service Model. The Service Model represents the Services an agency has in production. The Business Model represents the users and their requirements. The Implementation Models represent the technology underlying the Services. The Service Model becomes the

point of contact between the business and technology. The most important feature of the SOA Meta-model is in fact this description between the business and technology domains, coupled with the explicit modelling of the two-way interaction between. This balance enables the business to drive the technology in an environment of transformation [10].

The process of service-oriented modelling and architecture consists of three general steps: identification, specification and realization of services, components and flows [1]. The process of identification consists of a combination of top-down, bottom-up, and middle-out techniques of domain decomposition, existing asset analysis, and goal-service modelling. In the top-down view, a blueprint of business use cases provides the specification for business services.

It is important to start service classification into a service hierarchy, reflecting the composite nature of services. Classification helps determine composition and layering. Also, it helps minimize the service proliferation syndrome in which an increasing number of small-grained services get deployed with very little governance, resulting in major issues. The service realization recognizes that the software that realizes a given service must be selected or custom built. Other options that are available include integration, transformation, subscription and outsourcing of parts of the functionality using Web services.

4. M-Government Success Factors

The Model of Success Factors for M-government was developed following a comprehensive review of available literature. The available experience of governments and other government organizations around the world was used in the modelling. The model initially focuses on M-Government. However, the success factors are equally relevant considerations with each change in technology, such as a move from E-Government to M-government.

The Success Factors Model assumes a service delivery where the level of M-government sophistication positively correlates with the level of service delivery functionality. Five levels of functionality in electronic service delivery (mobile and web presence) are classified [3]:

- Basic – provides basic wireless access with non interactive responses.
- Advanced – delivers updated real time information or periodically enhanced material.
- Interactive – allows formal interactions between citizens and government service providers.
- Transactional – provides a single entity interaction for mobile and wireless users. Regardless of agency, a mobile request is executed through a single government interface.
- Fully interactive – offers a secure mobile wireless transaction through a single government interface for payment, ordering and billing of services. Agency independent, it offers the users anytime and anywhere access from a mobile wireless device with secure identification and authorization. It offers the ability to use critical data regardless of the device's size and susceptibility to loss or theft. You can have as many as sections and subsections you want. This may also have sub-sections.

The planning, development and implementation of services requires careful attention to the factors that promote or inhibit a successful project. The pillars of the model are:
Return of Investment – The need to investigate public funding of infrastructure and the options for joint ventures with private operators [9].

- Reengineering – There have to exist a centralized authority and political support over potentially fragmented/rival channels [9].
- Education – Wider communication of mobile wireless literacy is underlined [2].
- Security –Data integrity regardless of interface device particularly in relation to loss and theft is never to be compromised [3].

- Acceptance – Every agency or department should offer a seamless service via uniform mobile wireless interface with centralized shareable customer relation management backend for mobile wireless citizens.
- Infrastructure – Key infrastructure is understood to exist in order to provide mobile wireless connections to all constituents.

A common mobile public services framework must first and foremost incorporate the following five principles [2]: Interoperability, Security, Openness, Flexibility, and Scalability. Our recommendation of a service-oriented model stresses that interoperability is not just based on reading data on mobile devices from other systems, but that there must be functional coherence between the systems.

5. M-GOV Project

5.1 M-GOV Project Overview

The M-GOV (Mobile Services for Government) project is a research and innovation project at the Institute of Informatics, designed to encourage the access to new mobile and wireless public electronic services. The project is based on close cooperation between Public Authorities, SMEs and Universities. The main goal of M-GOV is to contribute to a development of a new cost-effective open public service platform for mobile citizens. The new platform will support usability, openness, interoperability and scalability. It will introduce the business model of close cooperation among the service providers, public authorities and citizens. The main M-GOV innovation is the Service Discovery Directory. It will enable discovery and instant consumption of new and available M-Government services in the current location of the mobile citizen wherever in Europe.

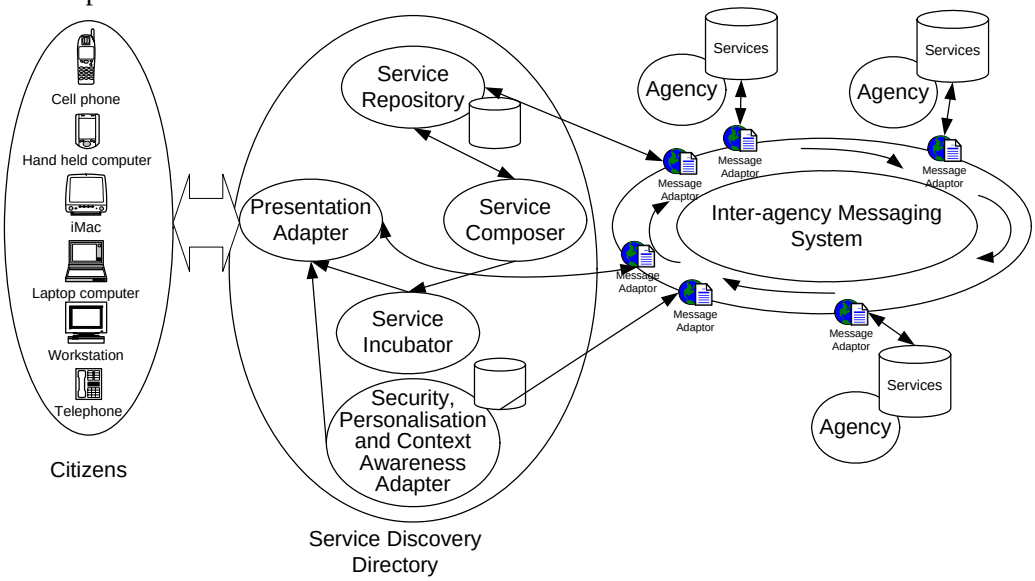

Figure 2. M-GOV Architecture

The M-GOV project aims to meet the following objectives: New models specifying how mobile services for multiple ambiances will be coupled, integrated, assembled and offered by various service providers; New communication platform that can support highly personalized mobile services, while adapting to different networks and protocols; Plug and Play environment for new mobile services; Implementation of optimized interfaces among the service providers, public authorities and citizens; and Innovative Service Discovery Directory.

5.2 M-GOV High Level Architecture

The M-GOV architecture as shown on Figure 2 is mainly formed of three major components: Citizens access devices, Service Discovery Directory and the Collection of public electronic services from various sources.

The citizens can access the electronic public services from anywhere, anytime from any Internet-connected device. The Service discovery directory consists of presentation adapter responsible for transferring the data in citizen device's acceptable form, Security Adapter with PKI infrastructure responsible for the security and privacy mechanisms in the framework, Service Repository that minds all the required information for available service consumption, Service Composer responsible for composition of complex services, and Service Incubator, a component responsible for state preservation, personalization, quality of service and adaptation of the current service in use.

The M-GOV platform communicates with the available public electronic services using an innovative circular messaging system. The agencies and the Service Discovery Directory use message adaptors to send and receive messages in predefined format. The goal of the message adaptors is to enable communication among systems working on different platforms.

5.3 Inter-agency Messaging System

The basic idea for the Inter-agency Messaging System (IAMS) is to use a flexible XML format called Mobile Government Extensible Language (MGML) in binary form (optimized for mobile environment). The flexible format will enable implementation of new services with different content. The format of the new service will be reported in the salutation phase with the Service Discovery Directory and stored in the Service Repository.

The interoperability is achieved through the use of Message Oriented Middleware (MOM) and a specialized set of messages for this domain. This middleware enables the exchange of messages between components as well as between different systems and platforms.

The only technological requirement placed on services by the M-GOV IAMS is the ability to communicate with XML messages. Agencies can use whatever technology they wish to talk to the IAMS via the transport adapters provided. This is one of the key interoperability principles of the IAMS architecture.

Because message exchange is fundamentally asynchronous, there is no need for agencies to have equally powerful technology in order to host services that exchange messages. The combination of transport adapters and asynchronous, persisted message queuing together minimize the amount of technology requirements.

The IAMS utilizes the concept of message adapters to wrap services from the technology used by other services. The IAMS provides a variety of message adapters that give services the illusion that all other services use the same messaging transport technology they do. This approach provides a high-level of technical interoperability between agencies that have heterogeneous technologies. Of course, for true interoperability agreement amongst the business owners over the structure and semantics of data is also required.

On the M-GOV IAMS, the synchronous abstraction is also made available to the services without compromising on robustness or reliability by means of a message adapter. This adapter gives the consuming service a synchronous invocation view of any M-GOV exposed service. Behind the scenes, the synchronous

message adapter uses a pair of messages – a request message and a response message – to invoke the destination service and retrieve a response.

However, the synchronous abstraction is not recommended because temporal decoupling is an important aspect of the M-GOV IAMS. The IAMS allows one agency service to send a message to another agency service. From the M-GOV's perspective, the final destination of that message is the second services outbox. This message queue is created, maintained and managed by the IAMS on behalf of the second service. It is up to the business owners of second service to pull their messages from the IAMS managed outbox. This has a number of loose coupling advantages [7]. The core of the design is a simple data message routing, auditing and security. In this manner, services can be started, stopped, upgraded without bringing the M-GOV system. This is obviously important in M-Government architectures where very high availability is a required.

5.4 Service Discovery Directory

The Service Discovery Directory (SDD) is based on the philosophy of Web Services. The client connects to the SDD over his/her mobile device. In the area of the citizen's presence, the SDD identifies the available public electronic services. The citizen's mobile client and the SDD exchange the MGML data formats and the electronic addresses of the available services. Then the client could continue communicating with the desired single service. If the service is not available for the specific client's platform, the SDD acts as an interface among the different environments. This enables the accessibility of merely all the known electronic services for citizens over theirs mobile and wireless devices.

The SDD contains components for Service Discovery, Service Composition, Service Selection and Service Execution, all of which are involved in the creation of the complex service offerings. Service discovery and composition in M-GOV is not a standalone function. It relies heavily for its innovative qualities within a Security, Personalisation and Context Awareness component. Service discovery uses personalisation within service selection, to select the service offerings for a particular service type that are most suited for a specific user profile. Personalisation uses context parameters.

Service discovery is the mechanism by which services conforming to a certain set of criteria are found in the Service Repository. It will return all services that support any of the discovery mechanisms as used by the M-GOV that conform to the criteria given. If the appropriate service is not found than the Service repository starts the internal service called Search Adapter. It uses a filter engine that evaluates a query against the discovered information from the comprehensive search of services in the M-GOV Platform. The Search Adapter's primary responsibility is to answer on demand queries for the availability and location of discovered services. The Service Repository uses a passive search to update its service list. The passive search is conducted for web services and also for propriety platform using mobile agents.

The Metadata stored by the repository contains the following information:

- Profile - contains basic information on service provider, on content being provided, on the context in which the service may be used as well as on the category of the service. This requires the introduction of content, context and service category ontology.
- Descriptor - describes precisely the service behaviour, which is defined by processes. Every service supports at least one process which may be executed. Most of the processes require data as input and provide output. Such data is described by the ontology of parameters, where every parameter is defined in concrete data types. Data type's definitions (grammar and vocabulary) are encoded in XML Schema.

The service discovery component is only one step in the overall service composition function. It is usually called several times during the construction of a composite service. This component is responsible for the discovery, registration and deregistration of all services within the M-GOV Platform. When the list of

services for one set of criteria has been found, they are then transferred to the Service Composer. This module then interacts with Security, Personalisation and Context Awareness Adapter to select the most appropriate services for the user, given their preferences and current context.

Once the service has been composed, it is the Service Incubator that looks after the composed service instantiating it as a complete service and monitoring it during its lifetime. The Service Incubator is also responsible for service adaptation. Service adaptation must not be confused with content adaptation. Service Adaptation encompasses content adaptation and more. Service adaptation can be carried out both during service composition and while the service is running. The adaptation of the service can be triggered by changes in context of the user. The adaptation occurs as the system constantly attempts to match the users' needs and the available resources and capabilities of the service, by constantly monitoring changes.

The Service Incubator closely cooperates with the Presentation Adapter. The Presentation Adapter actively responds to the information received from the Service Incubator and adopts the presentation of data to the appropriate quality, quantity and demand of the presentation device used at the given moment. For instance, a citizen reads the flash news from a governmental agency service on his/her PDA while coming to work. As he/her enters her office and logs in to his/her computer, the Presentation Adapter actively responds with enabling a full screen enriched data presentation. But not only the presentation is changed, but the quantity also, because the bigger screen enables presentation of more detailed information. You are requested to strictly follow the author's guidelines.

6. Conclusion and Future Work

The M-GOV platform is based on simple ideas that together provide architecture with high level of flexibility and low levels of technological requirements. The architecture is designed to scale, both from a technical and a financial perspective and to be applicable to integration scenarios from small agency scenarios through to large administration scenarios. The core technology concepts employed all proven technologies that are well suited to use in building a long lived M-Government infrastructure.

The system is implemented in laboratory scale. Future work includes tests on the functionality implemented in comprehensive real environment, and validation of the platform against similar systems, from the perspective of personalised service composition and service adaptation. It is also hoped to extend the adaptation process within the platform to optimise service performance in response to changing context conditions.

During the second half of 2006 the platform will be installed in the City of Skopje and at University Ss. Cyril and Methodius. The planned pilot validation services are:

- Mobile Student – it includes complete information sharing for the students at the university level. The system promotes context awareness providing the student with services adequate to her/his position.
- Mobile Citizen – It is a combination of several services about citizens including interactive information and complaints; traffic schedule and mobile parking; mobile survey and personal taxes and tax on property declaration

At the end, the M-GOV project will introduce a business model for cost-effective development of m-government service and recommendations for service planning.

References

[1] Ali Arsanjani, How to identify, specify, and realize services for your SOA, IBM Corporation, February 2005

[2] Antovski, Lj. And Gusev, M.(2005), *M-Government Framework*, Proceedings of the First European Conference on Mobile Government, (editors Ibrahim Kushchu and M. Halid Kuscu), 10-12 July, University Sussex, Broghton UK"
[3] Heeks, R. and Lallana, E. (2004), M-government benefits and challenges, http://www.e-devexchange.org/eGov/mgovprocon.htm
[4] IDABC (2006), eGovernment in the EU member states, eGovernment Observatory, IDABC Report, April 2006, 4th edition
[5] Jason Bloomberg, The SOA Implementation Framework, http://www.zapthink.com, April 2004
[6] Jeff Hanson, Coarse-grained Interfaces Enable Service Composition in SOA, JavaOne, August 2003
[7] Kishore Channabasavaiah and Kerrie Holly, IBM White Paper, *Migrating to a Service-Oriented Architecture*, April 2004
[8] KIT(2005), National Strategy for Information Society Development, http://www.kit.gov.mk , April 2005
[9] Kushchu, I. and Kuscu, H (2003), "From E-Government to M-Government: Facing the Inevitable", in the proceedings of European Conference on E-Government (ECEG 2003), Trinity College, Dublin
[10] Meta Group White Paper, Practical Approaches to Service-Oriented Architecture, November 2003
[11] Ministry of Justice of Macedonia (2006), E-Election List, http://www.izbirackispisok.gov.mk, May 2006
[12] Netsize (2005) 'The Netsize Guide', web: http://www.netsize.com, accessed 10.04.2006

About the Authors

LJUPCO ANTOVSKI was born in 1977. Since 2001 he is with the Institute of Informatics in Skopje, Macedonia. Currently he is a PhD student and a teaching/research assistant at the Institute. He is an active member of the Wireless Application Laboratory. He graduated in electrical engineering at the Faculty of Electrical Engineering in 2001, major in computer science and automation. Mobile and Wireless public electronic services are the field of both his research and PhD Theses. He has published several papers concerning the aspects of m-payments, e-banking and m-government.

MARJAN GUSEV was born in 1961. He is regular professor at the Institute of Informatics at the Faculty of Natural Sciences and Mathematics, St Cyril and Methodius University in Skopje, Macedonia, and manager of Wireless Application Laboratory and New Innovative Technologies Lab. He completed his PhD studies in Loughborough, UK and Ljubljana, Slovenia in the field of parallel processing. He has published many papers in the field of parallel processing, e-business and mobile applications.