

Technical Implications And Business Recommendations For Building Open And Interoperable Platform For M-Services Provisioning

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Abstract: *The paper focuses on the current outcomes of the USE-ME.GOV¹ project. It discusses in detail the research on usability of m-services in government to citizen (G2C) interaction. Specific attention is placed on the design approach for the architecture of the system and the impact of user requirements on system design. We also point to the concept of architectural dependencies among m-services as well as the need for proper service semantics. Furthermore, we present the research done on the topic of business models allowing the sustainable operation of such services.*

Keywords: eGovernment, mGovernment, mobile services, m-services, open platform, usability, sharing, openness, interoperability, scalability, business models

1. Introduction

Mobile communications and Internet technologies are bringing to bear the availability of as well as demand for new e-government services being ubiquitous available anytime and anywhere. Citizens are expecting to be served with new technologies in a secure, flexible, accessible, comprehensive, and easy way. Overcoming the problems of the digital divide means, if channels are not available, affordable or usable, other channels have to be offered to fill the gap and reach a maximum share of users (European Commission, 2004).

But, the large array of new communication technology opportunities, the rapid emergence and change of standards as well as the overwhelming variety of mobile devices offering different technical capabilities call for sustainable architectures and technology frameworks in order to pave the way to mGovern-

¹ The USE-ME.GOV research and development project is funded under the 6th Framework Programme (European Commission): IST – 1, Networked Businesses and Governments. The project started in January 2004 and will terminate in early 2006.

ment. In addition, business models and individual business plans are required to allow authorities to estimate investment and expected result when embarking to the mobile society. Authorities expect as return of investment that multi-channel strategies must offer better (effectiveness) or cheaper (efficiency) services (European Commission, 2004).

This is especially difficult for smaller authorities, municipalities or rural civil services, which do not only have low IT resources and investment for establishing electronic service delivery, but also serve a great variety of service types to mostly only limited number of customers (citizens). Well known and often cited examples of eGovernment services are mostly operated by larger authorities with a large clientele and a more focused business segment like tax offices (Leenes, Svensson, 2002).

Project USE-ME.GOV develops an open platform for m-Government services that will enable citizens to access most appropriate services with personalized content that will be provided by local authorities anytime and anywhere. The proposed solution will be cost-effective and efficient in order to benefit especially smaller local authorities.

The open platform for m-Government services will support usability, sharing, openness, interoperability, and scalability, thus facilitating service deployment and access. The work includes also the elaboration of comprehensive business models considering different stakeholders, such as service providers, public authorities and citizens, taking into account individual regulatory frameworks. In order to achieve this aim the work in the project is focused on the creation of:

1. *Open Service Platform for Mobile Government* (meeting the most critical usability, interoperability and scalability requirements as well as supporting shared use between public organisations and respective departments),
2. *Comprehensive Business Models for Mobile Government* (compiling interests and roles of relevant stakeholders and correlating their roles and interests in distinct service and business scenarios)
3. *Recommendations for Service Planning* (including aspects of technology, standards and business operation to serve as an example for “others” when planning similar services).

This paper will concentrate on the research on usability aspects, the corresponding architectural design and the general set-up for business modelling in the USE-ME.GOV project. Further information about the project can be found on the project home page (USE-ME.GOV URL).

2. m-services

m-Government discusses for each of its applications the pros and cons of mobile channel approaches (Harkin, 2003). What is the added value of m-services compared to typical government services provided over the fixed line Internet? The answer is certainly mobility. Users that stay in certain contexts are eager to make use of mobile applications if they are personalised and presented in a usable way. Being blocked by a traffic jam, being on the move in public transportation means, or having urgent needs, all these situations encourage the use of mobile services. Possible examples include checking if there are any related news provided by local authorities, making an appointment with the doctor, issuing a complaint etc. These services may be accessed at any time and anywhere. Moreover, current technology enables service providers to present to the user the most appropriate information according to her profile and her context (location, time, terminal). Main disadvantages of this approach are cumbersome input (stylus, small keyboard) and output modalities (small screen), as well as great latencies of network traffic.

In spite of these limitations, the fast growing rate of mobile phone users in conjunction with usability features makes this medium the primary communication channel for the USE-ME.GOV platform.

The USE-ME.GOV project focuses on providing both citizens and authorities with usable and useful applications. Authorities will be offered a system which:

1. enables sharing of common modules with other departments (within one administrative body) or other authorities,
2. ensures platform security and operation by open source transparency,

3. allows for easy estimation of efforts, outcome and benefits
4. is easy to deploy and configure,
5. is independent of mobile operator-

Moreover, this solution must satisfy the usability requirements by the utilisation of adaptive (to terminal capabilities) and user-friendly interfaces for both the platform and added value services.

To satisfy these objectives the user requirements analysis has been conducted. The methodology adopted can be described as a sequential flow of activities. The starting point of the analysis is devoted to the description of the four cities and regions represented by the project partners emphasising mainly individual socio-demographic conditions concerning economic activities and discussing other regional key issues. These are the foundation for specifying strategic interests of the partners, however, considered through the prism of the IST strategy and objectives. The analysis takes into account existing as well as planned initiatives for IST and services utilisation. The next step in the methodology was the analysis of the selected services that deal with strategic goals, detailed descriptions, and identified segments of users. Particular attention was paid to gained benefits for citizens, authorities, businesses, and the community as a whole. The analysis finalised with the user requirements summary which is the basis for further research in providing recommendations for m-services exploitation.

For dissemination and exploitation purposes, various parties were contacted and interviewed. The interview parties were from different domains in order to capture a wide range of perspectives. The parties varied in terms of population, size, development, financial strength, IT maturity as well as needs and strategic goals. What also distinguishes the partners are social and cultural differences. Diverse characteristics of partners lead to partner-specific services that will be developed in the project (e.g. *mobile students, healthcare*). It was also important for the project members to design services that instead of different functionalities fulfil common objectives and characteristics (e.g. delivery of information from authorities). The existence of common features allowed for the following grouping of the services into:

Dissemination of Generic Public Information: Services in this group generally adhere to the idea of better and wider access to existing information services offered by authorities. Some of those services may be provided already via internet and therefore the mobile channel might either boost the accessibility of the service even more or at least extend the current web service for better convenience.

Personalised Information Services: This type of services allows for better adaptation to the specific user status, situation, needs, and processes. Such services require much more intensity in personalisation and utilisation of profiling and context-aware techniques. These two first types of services may sometimes naturally overlap with each other offering characteristics common for both groups. For instance, information from authorities concerning unexpected events or critical situations that is from a thematic point of view relevant to the entire community may be disseminated only to a specific target group of users that is chosen on the basis of their context (location, time, preferences etc.).

Spontaneous Community Interaction: The main effort is put on services that increase the interaction level between citizens and authorities. Offering common and ubiquitous means of access, such services are ideal for handling with issues like the submission of complaints on various topics, suggestions and some particular requests. It is highly important that the submission of a complaint would not be only another notification of problems, but instead, it has to initiate an interactive process in which authorities and citizens may interchange messages on further details as well as solution proposals.

Mobile Promotion: These kinds of services are very similar to generic public information services. However, they are aimed rather on the promotion of specific local events, interesting places, cultural institutions, or even businesses.

The analysis carried out resulted in an identification of major goals and benefits for all actors in the business chain. Most of the aspects are related to either an increase in service efficiency (e.g. reduction of processing time, anywhere and anytime contact, broader dissemination) and in service quality (faster and more convenient). Very important are also issues regarding the level of relationships between citi-

zens and authorities and their public image (increase of public awareness). The undeniable advantages come further from the reduction of costs of organisation and communication as well as from profits of local businesses.

The user requirement analysis is the basis for more precise and detailed service description and more suitable architecture design.

2.1. Technical aspects of m-services

2.1.1. Technical objectives - conformance to the user requirements and current trends

Requirements put emphasis on certain technological directions that a potential solution should follow. User requirements demand in general diversity of capabilities in one nice packaged product. Users want to have their authority at their fingertips meaning that each possible request should be efficiently dealt with. This leads to the conclusion that architectural decisions should aim at the provision of low coupled technological objectives in a distributed architecture. External entities should be provided with the opportunity to easily join up to such a framework, extend it and work with the platform's existing functionalities.

On the other hand, we encountered a strong pressure from the content providers' side (represented by local authorities actors) to select our technical objectives that required effort for local authorities are minimized. Effort is quantified not only in terms of simple financial effort, but also in organisational burden by running a full cycle project.

Based on the user and authorities requirements as well as scientific goals of the USE-ME.GOV project the following technical requirements have been derived.

Openness. The solution should be open to other entities and actors that want to participate in the USE-ME.GOV community. The platform should by no means limit the possibility and chances of other units to participate. However, certain entry burdens always exist; therefore, the project aims at minimizing such efforts. Also, the main ideological goal of the project depends on the sharing of content. In terms of openness it means that once a unit overcomes all organisational-bound obstacles it should be easy for it to provide information services to the USE-ME.GOV community.

Interoperability. The platform should have mechanisms for technical and semantic interoperability. Parts of the systems should not only communicate on the technical level, but also on the semantic. Therefore, coherent and unambiguous representation of acting services should be provided.

Scalability. The platform should be scalable in terms of amount of incoming requests from actors, as well as internal efficiency and good design.

Security. In the local administration environment certain citizen data and information should be treated with a special care. This imposes a definition of strict, modular authentication and authorisation rules for the framework.

Usability. User orientation imposes a clear and usable design of user interfaces. Also, the project team analysed personalisation rules for citizens. It is our goal to provide personalised, up-to-date and context-aware information to citizens by mobile means.

2.1.2. Vision of architectural dependencies among services and USE-ME.GOV platform

In order to meet the expectations of the growing mobile market it was decided to design the USE-ME.GOV platform as an application of *Service Oriented Architecture*, namely the *Web Services Architecture*² (WSA).

² <http://www.w3.org/TR/ws-arch/>

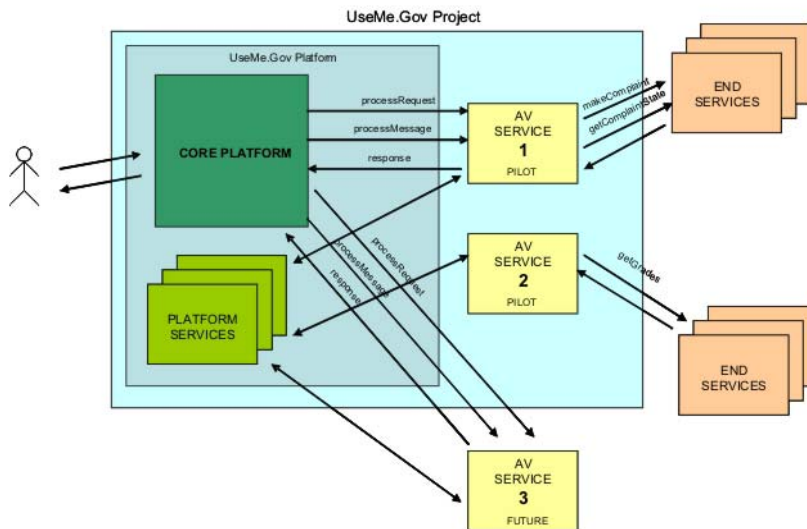


Figure 1 - General relation between the USE-ME.GOV platform and its services

Leaving a detailed description of the platform itself, it should be noted that the provision of a WSA resulted in low-coupled, fine-grained components. Each new entity can register itself within the framework and coexist on a technological level. Moreover, it could also describe itself in a special component for service registration. Then, a specific component (described further in the next subchapter) is capable of discovering certain facts about the provisioned service and therefore allow for semantic interoperability. The set of defined services is extensible. Encapsulation in a service can take place with regards to content and functionalities service providers and local authorities provide. Relations between the platform itself and its services is conducted with the utilisation of well-known open standards, namely HTTP, XML and SOAP messages, as recommended in the WSA definition.

2.1.3. *Need for proper description and semantics*

Since the USE-ME.GOV is designed as a distributed system which components may be operated by different organisations and which extensions may be designed for and operated on different platforms interoperability become a major issue. Interoperability is defined by the EC as:

a chain that allows information and computer systems to be joined up both within organisations and then across organisational boundaries with other organisations, administrations, enterprises or citizens (European Commission, 2003b)

This complex goal can be achieved if its three main aspects are carefully analysed and addressed:

1. *Organisational interoperability* related to the co-operation of business processes, sharing resources, costs and revenues. This issue is addressed by the creation of business models and recommendations for platform operation (see next chapter).
2. *Technical interoperability* allows systems to exchange messages and invoke operations on each other. The USE-ME.GOV platform is an instance of the Web Services Architecture (WSA) defined by W3C, which does not prejudice any technological choices. This gap requires the careful selection of non-proprietary standards used to deliver services that may potentially gain substantial penetration of the market. USE-ME.GOV is intended to conform to

WS-I Basic Profile³ created by WebServices Interoperability Organisation which defines a set of named specifications along with implementation guidelines for services provisioning.

3. *Semantic interoperability* is neither the part of the WSA and must be treated separately by the introduction of a *Meta-Protocol of Service Types* concept.

Every service registered in the platform regardless its type and implementation has a certain behaviour. Semantic interoperability is achieved when service requester and service provider have a common understanding of this behaviour.

Meta-Protocol of Service Types constitutes a framework which allows to express the semantics of the service in a machine processable form. In case of USE-ME.GOV the description of the service consist of three parts, which are established by the so-called OWL-S ontology⁴:

1. *ServiceProfile* 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 ontologies.
2. *ServiceModel* 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. For the sake of interoperability data types definitions (grammar and vocabulary) are encoded in XML Schema⁵.
3. *ServiceGrounding* is used during the process execution, and it contains certain mappings from service model to service interface.

Assuming an ontological commitment of all parties involved, the service requester may use inbuilt framework inference mechanism (Jena⁶) to search for services which provide a certain behaviour, which in turn are described by the process the service supports, by the input and output parameters or by the content the service provides.

3. Business recommendations

One of the main objectives of USE-ME.GOV is not only the development of the mobile platform, but also to ensure a sustainable operation of the platform after the end of the project by corresponding business models. This task should also result in general recommendations for similar projects or activities undertaken.

Business models for the planning and design of multi-channel services are essential to estimate investment and expected result for all stakeholders in value chains. They are often investigated for commercial services, but new and sometimes neglected when talking about governmental *business* or public private partnerships. Financing of public IT services is a problem in times of cutbacks of public expenditures, and hardly any revenue generating projects can be found. Most are financed by the service providers, i.e. the authorities themselves, as a mean to improve internal organisation and improved interchange with the citizen.

The work on business models in USE-ME.GOV tried to collect similar approaches from research as well as other organisations and projects, with the aim to derive core attributes, and moreover learn from their experiences. But literature and real world examples showed that the term business model is mostly used as “peripheral term” or “black box” (Hawkins, 2001) giving no commonly accepted definition (Bouwman, 2002; Lambert, 2003; mGain, 2003; Vassilopoulou et al., 2003), or clearer insight in who is cooperating with whom and which information and revenue flow was exchanged. Besides different explanations in research literature, it seems that conventional news and publications use the expression “business model” very often as a buzzword in order to praise the business character and profitability of

³ <http://www.ws-i.org/Profiles/BasicProfile-1.0-2004-04-16.html>

⁴ <http://www.daml.org/services/owl-s/1.0/>

⁵ <http://www.w3.org/XML/Schema>

⁶ <http://jena.sourceforge.net/>

a venture. Moreover, the definitions are circling around the area of eCommerce and do not take into account authorities as key player with respect to public private partnerships or collaborations with the private sector.

Another point is the topic of value generation in business models which is in the domain of eCommerce certainly concentrated on monetary value. But for authorities the fulfilment of policies like “reaching more citizens”, “providing a better service”, “improving internal organisation” and resulting less investment for better service provision is the main driver for establishing mGovernment. But such results are difficult to measure in single terms of figures.

In USE-ME.GOV we started with the identification of services and their characteristics, and extracting actors and roles and also including possible actors operating different parts of the USE-ME.GOV system. Then, the authorities were asked to provide information on how they expect that the system will be operated and where costs will occur and revenues might be possible. It showed that authorities tend to bear all costs of operation, and put their expectations of funding more in national funding but in options for sharing with other municipal authorities or commercial partnerships. Pricing of users are seen as not feasible as the service are not appraised as of high monetary value. Only the sending of SMS to the authorities might be charged via the citizen’s mobile phone bill, but this revenue will certainly be pocketed by the mobile operators for the mobile transaction.

The common business model for USE-ME.GOV services is depicted in the following figure (presented without costs and revenues and information flow).

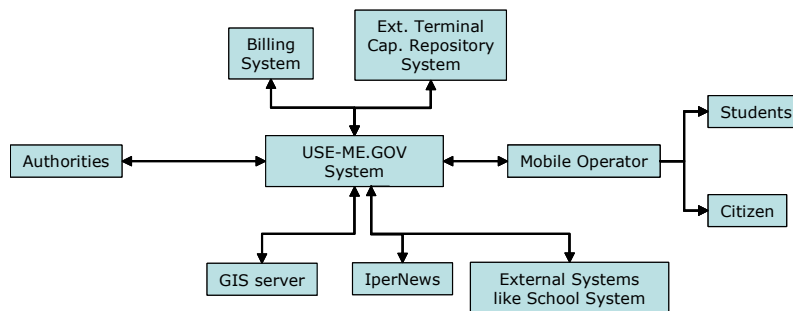


Figure 2 – Actors and interactions identified in USE-ME.GOV

As presented the main actors in this business model can be reduced to authorities in the role of information providers, the operator of the USE-ME.GOV system as interconnector to the mobile operator and finally the end user like citizens or students. External systems or their operators respectively can be integrated as required from each service. The billing system, for example, is only required if the citizens are expected to pay for the service per subscription or per call, and the payment is not conducted by the mobile operator. Then, an external billing service has to be ordered which in turn will cause costs diminishing the revenues.

For elaborating how the services might be better financed we identified the following options:

- pricing of the users (i.e. subscription or pay-per-call)
- partnerships with commercial organisations (overtaking partly or in total the operation of the USE-ME.GOV system or the sending and receiving of the SMS as done by the mobile operator)
- sharing of service(s) with other public organisations
- sharing of platform with other public organisations
- selling of service or platform software to other municipalities
- advertising and/or sponsoring

Project USE-ME.GOV is currently investigating which options for the business operation of the individual USE-ME.GOV services are technically, politically and economically feasible. But for negotiation

with commercial companies and contacts with other municipal organisations first the obstacles and frameworks have to be settled. As a first step we elaborated for the services in USE-ME.GOV the following caveats which have to be taken into account for investigation and negotiation.

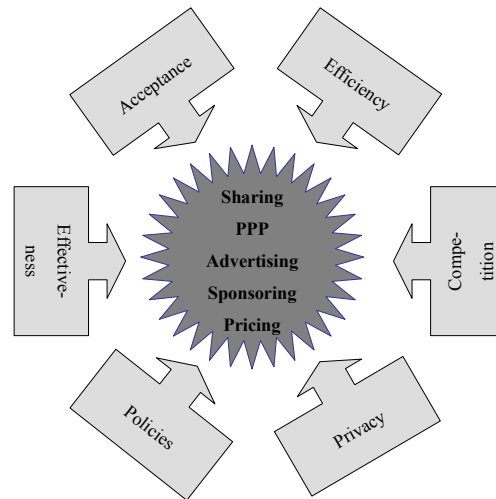


Figure 3 - Options and caveats for USE-ME.GOV business model

Acceptance of customers, habits: citizens in different European countries show a different acceptance of technology and use. This results also in a difference of pricing acceptance. As for example project APNEE showed, North-European countries accept higher prices for mobile services than citizens from southern Europe (Rose, Peinel (2004)). In addition, younger and older customers differ in their acceptance of technology, especially with regard to mobile technology. It should be carefully evaluated, who is the normal customer for the intended service in order to be not confronted with the digital divide phenomena.

Privacy problems: Some services like the healthcare or student information services in USE-ME.GOV store sensitive data about the users. This data might give information about individual health states or the marks in specific subjects of courses, which of course should be protected by any misuse. This requires a careful negotiation and contract with commercial partners. Unfortunately, Public-Private-Partnerships for information service chains are relatively new to authorities, and therefore state legislation does not provide reference contracts which could settle such issues in a general applicable and guaranteed way.

Competition with commercial market: Not every possible service has to be and should be operated by authorities, not only from a financial and effort point of view, but because governmental activities should not interfere with the private market. In some states of Europe government competition with the private sector are forbidden by law to avoid precluding other entities from developing markets (Weiss, 2002). While services with direct interaction with the citizen might be better under control of the authorities for example due to privacy problems, especially pure information services can be also realised by offering a specific interface in a standard format, and allowing external commercial providers to process it to the user. But, this might in turn hinder governmental policies like reaching all citizens (no influence on the provider whom to select as customer, see also below) or offering the information for free to satisfy information needs of the public (providers might charge for the information).

Policies: The reuse of public sector information (PSI) bears large economic value (European Commission, 2000) and the new directive about the reuse of public sector information (European Commission, 2003) tries to pave the way for commercialisation of PSI. But, the authorities must be careful in selecting which information service can be delegated to commercial service providers since the strategy of the market to earn money by covering a large customer base might not fit to the state policy to reach every citizen independent of age, income and ability. It must also be as-

sured that commercial companies do not control the information flow between citizen and government and such can influence and select content and reach.

Advertising, sponsoring: Advertising should not be seen as cash cow which can finance all expenses, but some advertising of selected companies or products can support the operation of public services. Also sponsoring can be paid back by presenting the logos of sponsoring companies or other textual naming in dissemination material. Commercial advertising - like done by companies like DoubleClick - offer a streaming interface where advertising was sent from a server to the requesting channel depending on parameters and cookie information. But this uncontrolled type of advertising might also conflict with state policies. Ringtone subscription for younger students, gambling and betting offers, smoking and drinking ads can be a disaccord to state endeavours concerning health policies or protection of the youth. Such advertising must be therefore carefully negotiated in advance. Sponsoring and advertising has to be checked also against user acceptance. Some users might find it improper, some feel irritated, and some might think the information is tampered by the advertising company.

Efficiency and effectiveness: Effectiveness can only be measured by installation and operation and finally test whether an improvement of organisational processes took place. This has to be done during the validation phase of service giving also feedback from the citizen. Measures of success will allow to quantify the results and such evaluate the success, but also investment and costs. Efficiency of services includes also the measurement of improvements by reorganisation actions and long term profitableness, which might be hard to express in numbers due to side effects like change of workflow, employment of new software which is also used for other services and the like. Efficiency and effectiveness will certainly be the core measurements for decisions but represent the most difficult targets to specify and measure.

4. Conclusion

The paper presented the current outcomes of the USE-ME.GOV project concentrating on the work done for system architecture and business models. First of all, it put a strong emphasis on the meaning of user requirements to the architectural decisions. Users want to extend the platform functionality for specific needs. On the architectural level this means that the system is expected to provide openness and interoperability. We presented how to relate these architectural requirements to m-services provisioning.

Even implemented well, such mobile services have to operated also after the end of the project, means also after the end of public funding, We therefore presented the work on business models which reflected how difficult it is to find the balance between options of value chain implementation and regulatory ties. The individual business models chosen as well as reasons for selection will be presented in further publications.

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