Accounting and Management Information Systems
Vol. 8, No. 3, pp. 445 – 468, 2009

THE NEW DIMENSIONS OF THE VIRTUAL PUBLIC ENVIRONMENT

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ABSTRACT

The European public administrations aim to develop a transparent, accessible and translatable profile to answer to the cross-boundary, cross-sector and multilingual reality of the European area. One of the main sources of development and innovation at the public administration level consists of the opportunities created by the convergence manifested in the field both of technologies and activities. This paper describes the new context in which public administrations operate, developing on the parameters that sustain efficiency, performance and transparency to facilitate access to successful governance and implementation of innovative solutions for interoperability, provided by information and communication technologies and translated as advantages for all the actors involved. Based on the integrated information systems implemented within the 2nd District City Hall and the Bucharest General City Hall, the author presents a case study of interoperability between the taxes and fees application and the GIS module functional within the two institutions.

eGovernment, IIS, interoperability, XML, Web

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INTRODUCTION

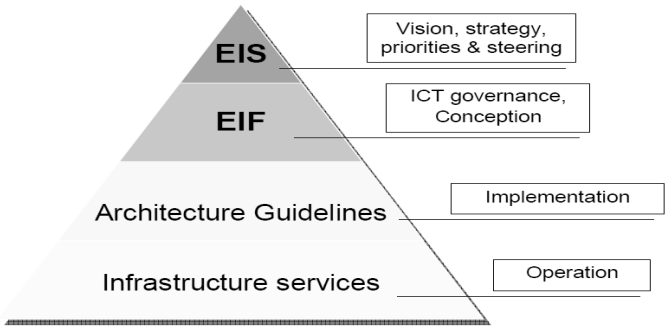
The strategies and the policies adopted by the European leaders in the last decade require solid profile upgrades for the public administrations across Europe, in order to develop the framework that facilitates the implementation of their pan-European dimension and the assimilation of this feature. The European public administrations should develop a transparent, accessible and translatable profile to answer to the cross-boundary, cross-sector and multilingual reality of the European area.

One of the main sources of development and innovation at the public administration level consists of the opportunities created by the convergence manifested in the field both of technologies and activities. All the management activities represent an opportunity to integrate new thinking systems and to add value through collaboration.
"Interoperability is an essential requirement for the implementation of eGovernment in Romania", the IT State Secretary has declared at the end of 2003, emphasizing on the fact that for the future it is very important to assure "the interoperability between the existent information systems implemented at different levels of the public administration" (Ticau, 2003).

In 2004, the European leaders have adopted in Brussels the European Interoperability Framework (EIF) as a result of an extended consulting process with the Member States (MS), representing the highest level of implementation for eGovernment services in Europe (EC 2004).

On the agenda for 2009, the European Union (EU) leaders have included the adoption of the European Interoperability Strategy (EIS) that aims to serve the policy priorities, to be closely connected to the realities of the European citizens, and to increase the value of the efforts made at national level (Moran F.G., 2008). This strategy shall be aligned with the policy priorities of the EU, creating new synergies between the activities of the MS and those of the EU.

Figure 1. **Cross-boundary Interoperability among Member State Administrations**



The development of efficient public services, customized according to the needs of the citizens and businesses, require a continuous flow of information between administrations.

This paper presents the new context in which public administrations operate, developing on the parameters that sustain efficiency, performance and transparency to facilitate access to successful governance and implementation of innovative solutions for interoperability, provided by information and communication technologies and translated as advantages for all the actors involved. In this regard, based on the integrated information systems implemented within the 2nd District City Hall and the Bucharest General City Hall, the author shall present a case study of interoperability between the taxes and fee application and the GIS module functional within the two institutions. The feasibility studies concluded within the 2nd District City Hall for such interoperability services indicate the utility, as well as the opportunity for further development.

1. INTEROPERABILITY AND INFORMATION SHARING WITHIN PUBLIC ADMINISTRATIONS

European Public Administrations are committed to increased their overall efficiency, effectiveness, quality and customer-orientation, as well as optimise their internal; and external communication, by comprehensive modernisation and the automation of processes.

These objectives can be achieved through the use of information technologies. In order to design the various applications in a way that is future-proof, media-consistent and universally accessible, standards for the creation of interoperable information and communication systems are indispensable.

1.1 Interoperability in eGovernment

In the last decade, local public administrations have invested in the implementation of information technologies, in terms of reliable and efficient application and of development of powerful hardware equipment. Based on the existing software and hardware infrastructures, and with the increasing degree of networking between authorities and the application of available standards, technical interoperability is already possible in most public organizations. To make administrative applications interoperable, the level of content and semantics must also be addressed.
Interoperability describes the capability of semantically heterogeneous information and communication systems to operate together in a seamless and media-consistent way. The purpose of interoperability consists in efficient and effective exchange of information between systems and it is usually implemented through the unification of data structures, file formats and protocols.

The European Interoperability Framework definition identifies three separate aspects (Zechner, 2007):

- Technical, linking up computer systems by agreeing on standards for presenting, collecting, exchanging, processing, transporting data.
- Semantic, ensuring that transported data shares the same meaning for link-up systems.
- Organisational, organising business processes and internal organisation structures for better exchange of data.

1.1.1 Technical interoperability

The capability for seamless electronic data exchanges is called technical interoperability. Technical interoperability includes the identification of transfer channels and protocols (such as SOAP, HTTP, FTP, IP, SMTP). A common language for data description is also necessary technical requirement for interoperability. The XML language permits flexible data description. Yet although the open and platform-independent XML language supports the interoperability of applications, it does not guarantee it. Technical interoperability and technology standards should ensure that information and communication systems are able to exchange information without problems. In order to make this unified eGovernment standards available to administrations, suitable measures and procedures need to be developed for implementing interoperable information and communication technologies between the central and local levels.

1.1.2 Semantic interoperability

XML provides the technological framework for electronic data exchange. Yet in the same way that striving together correct words of a language does not necessarily make a meaningful sentence, agreeing to use XML does not enable IT systems to communicate with each other and interoperate.

In order to exchange data between systems and applications in a meaningful way it is critical to provide for interoperability not just on a technical level, but also semantically. Semantic interoperability exists if, in a data exchange between two systems, the data is interpreted in the same way by both parties, ruling out misinterpretations. This applies not just to the form, but also to the content of the data.
The only way to achieve semantic interoperability is through the definition of a unified form of representation and unified semantics for the elements of the exchanged XML files. This can be done by specifying XML schemas (XSD), or by applying the Regular Language Description for XML New Generation.

Beyond that, the documentation of the schemas must ensure that meta-information is interpreted consistently by all parties. Documentation must stipulate, for example whether or not the “street” element of an address contains the number, or whether the “first name” element may contain several names or just one.

Suitable standards are required to ensure semantic interoperability, enabling systems to "intelligibly" exchange information without depending on human interpretation.
In order to ensure this kind of semantic consistency in the use of information and communication technologies between the central and local levels it is necessary to accelerate the development of inter-authority terminology.

1.1.3 Organisational interoperability

Organisational interoperability mainly deals with two issues. Why is particular data being exchanged, and when does the exchange take place? The framework of organisational interoperability specifically serves to align the processes leading to a data exchange. The legal environment and legal stipulation, such as laws and regulation, are also taken into account when evaluating the processes and data. Although organisational interoperability is a precondition for a successful exchange of data, it does not by itself provide the means for actual, electronic data exchange.

Interoperable information and communication systems are able to improve an administration's workflow. Administrative workflows are rationalized by the channelling of communication, processing and logistics, the standardization of records, information and procedures, the automation of occupations like writing, calculations, processing and communication, as well as by coordination through workflow management systems, electronic scheduling and training.

Through interoperable use of databases, as well as specialist and leadership information systems the ability of an administration to provide information may be increased. On the one hand customer request may be answered promptly; on the other hand internal decision-making may be accelerated.

An interoperable eGovernment system has different components, among which the author specifies the following:

- Citizens and Business ("users");
- Multiple Access Channels;
- Portals (Local Authority, Government, Private Sector);
- Infrastructure (Government Gateway);
- Government Systems (Local Authorities, Departmental Systems, Other Public Sector Systems). These components require different kinds of interoperability for different groups (citizens, enterprises, and other government entities).
- Interoperability with individuals/citizens is typically accomplished primarily through Internet/Web Browser interfaces. It also includes direct data exchanges (e.g., file transfers of tax form submissions), mobile communications, etc., which are likely to grow in importance over the next five to ten years.
- Interoperability with private enterprises must take into account that enterprises have a wide range of systems. It may be accomplished

through the same ICT vehicles as are used with individuals/citizens but may also involve more sophisticated business-to-Government data exchanges and the like.

- Government and public authorities seeking interoperability both within their own administration and with others face the same interoperability challenges that private enterprises face in accomplishing enterprise application integration (EAI) and business-to-business (B2B) integration, such as business process alignment, data semantics resolution. Interoperability with other governmental entities must take into account the diverse application software systems and ICT hardware that governmental entities already have in place as well as local governmental business processes predicated on local and national laws.

To conclude, depending on the area of application (organisational, content transfer, interpretation of content), interoperability has different levels:

Table 1. **Examples of Interoperability**

Level of interoperability	Technology methodology	Example	Description
Organisational	Process coordination	Two authorities agree to exchange personal data.	It needs to be clarified on an organisational level when and why data is being exchanged.
Technical	XML	< ?xml version= »1.0 » ?> <element1 attribut1= »wert1 » Attribut2= »wert2 » />	A unified language, as well as data transfer channels and protocols need to be specified.
	SOAP	< ?xml version= »1.0 » encoding= « UTF-8 » ?> <soapenv: Envelope> <soapenv :Body> … </soapenv :Body> <soapenv:Envelope>	
	HTTP	POST / site.html http / 1.1 Host : www.homepage.de	
Semantic	XSD + documentation	<xsd :element name= »name » type= »xsd :string » minOccurence= »1 »/> <xsd:element name="Beruf" type="xsd:string" minOccurence="0"/> Occupation are identified according to the BfA's occupational group key as of Nov 19, 2000	A unified grammar and semantics need to be defined.

(*Source*: Zechner, 2007: 122)

1.2 Potential of interoperability in eGovernment

Interoperable and media-consistent information and communication systems accelerate the transfer of data (Zechner A., 2007:124). For example, post offices internal to an authority or express and mail services that have served as carriers of information in the past are increasingly being replaced by the Internet. In the past, transfer by traditional means often took more than 24 hours. By implementation of email and fax services, these transfer times are minimized down to a few seconds, and the documents are sent directly to the recipient.

Lead times for administrative process can be minimized by providing records, application forms and related documents online, as well as by automatically compiling and forwarding documents between interoperable systems. Media consistency and interoperability of eGovernment applications avoid waste of time ensuing from erroneous or incomplete information. Queue times are also reduced, e.g. by accelerating transfer. Processing and decision-making may be accelerated by using interoperable workflow management and groupware systems that allow prompt document exchange and parallel drafting of statements, as well as parallel processing and decision-making.

Interoperable information and communication systems may also contribute to minimizing unproductive occupations and redundancies. Reducing the number of errors is an important quality issue. If all the information pertaining to an administrative process is presented by interoperable and media-consistent office communication, workflow and document management systems, processing errors and mistaken decisions may be reduced. This in return will reduce the number of objections, lawsuits, appeals and revisions in response to official letters.

The ubiquitous and continuous nature of the Internet increases availability to the customer. Customers (citizens, businesses, administration workers) are able to attend to their matters in a single contact. Customers don't need to appear in person before several authorities or tolerate long queues, since administration systems are able to perform interoperable and media-consistent data exchange.

Aside from quality and service enhancement for the customers, the job environment for administration workers also improves. Thanks to the lightening of the load caused by menial and unproductive chores like feeding databases with information from paper forms, workers are able to apply their productivity to the core tasks of their administration.

If processes related to a particular processes module are changed, the implementation of changes may be facilitated by wide-area, centralized deployment. The basic purpose of service types is to characterise services from their initialisation by the customer up to their completion by the authority, i.e. in the widest sense unify them. Each service type is illustrated by sample process supervisors and their co-workers who intend to make a service available online and optimise the service workflow.

The online-capable services of the public administrations can be classified into nine service types, see Table 2.

Table 2. **Classified the online-capable services**

Service type	Description
Type 1	Information
Type 2	Consulting
Type 3	Preparation for political decision-making
Type 4	Cooperation with and between authorities
Type 5	General application procedures (without allocation of founds)
Type 6	Subsidies (with allocation of founds)
Type 7	Procurement and distribution
Type 8	Supervision
Type 9	Miscellaneous services

(*Source*: Zechner, 2007: 127)

Sample workflow models covering the following areas:

- General application procedures (Type 5)
- Procurement, eTender (Type 7)
- Subsidies (Type 6)
- Monetary transactions, ePayment (Type 7)

1.3 Interaction scenarios

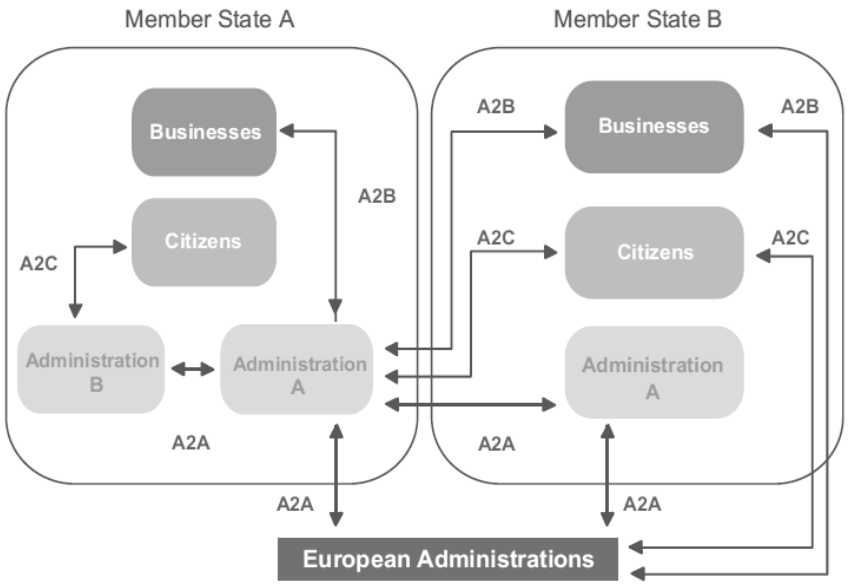
The massive size, semantic heterogeneity, autonomy, and distributed nature of the data repositories present significant hurdles in acquiring useful knowledge from the available data. Against this background, there is an urgent need for implementing interoperability scenarios that permit knowledge acquisition from autonomous, semantically heterogeneous, distributed information sources (Caragea *et al.*, 2005).

In the most general form of interoperability, can be defined three interaction types that cover most of the current trans-border eGovernment services (EC 2004):

- Direct interaction between citizens or enterprises of one particular Member State with administrations of other Member States and/or European institutions.

- The exchange of data between administrations of different Member States in order to resolve cases that citizens or enterprises may raise with the administration of their own country.
- The exchange of data between various EU Institutions/Agencies or between an EU Institution/Agency and one or more administrations of Member States.

Figure 2. **Complex Interaction scenarios** (*EC 2000)*



A2A: administration to administration - A2B: administration to business - A2C: administration to citizen

In order to implement such interaction scenarios for eGovernment services set up at pan-European level, it is recommended to take into account the following general principles:

- Accessibility
- Multilingualism
- Security
- Privacy
- Subsidiarity
- Use of Open Standards
- Assess the benefits of Open Source Software
- Use of Multilateral Solutions

2. INTEGRATED INFORMATIONAL SYSTEMS FOR PUBLIC ADMINISTRATION

Romania, as a Member State, has aimed to align the public sector to the European standards and best practices. The Government strategies in the last decades focused on the implementation of consistent hardware and software architectures within public administrations, and on developing solid competencies for the public servants.

2.1 Information technologies for sustainable development

Interoperability can be implemented in any fields of activity by following certain principles of development (Balram & Dragicevic, 2006). Large and complex information systems need to interoperate, in order to achieve their full potential in the public environment. Interoperability brings numerous opportunities for development, driven by the possibility of interconnecting local and central public administrations.
This integrated public environment is facilitated by the service oriented architecture (SOA), which has been widely adopted to solve the interoperability of the involving heterogeneous distributed systems (Sartipi *et al.*, 2008).

2.1.1 Service Oriented Architecture

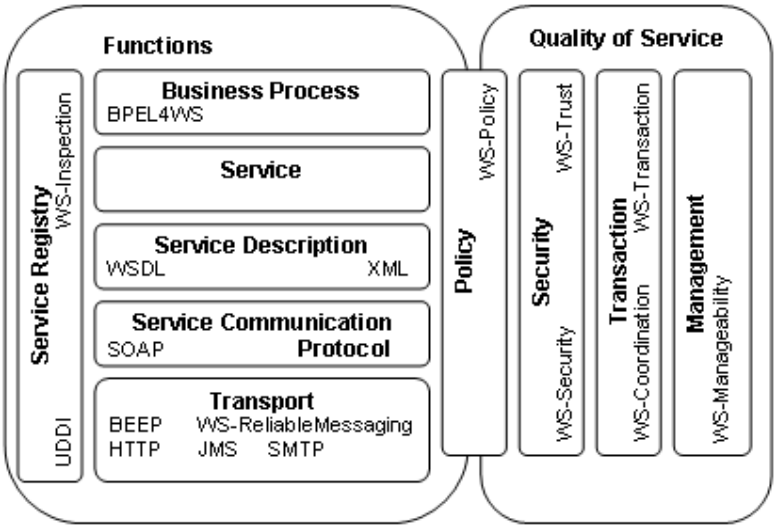
Service Oriented Architecture (SOA) (Krafzig *et al.*, 2004) plays a key role in the integration of heterogeneous systems by the means of services that represent different system functionality independent from the underlying platforms or programming languages. SOA contributes in relaxing the complexity, leveraging the usability, and improving the agility of services. On the other hand, new services may need to be adopted by the SOA community. Service is a program that interacts with users or other programs via message exchanges. An (SOA) consists of the following concepts: application frontend, service, service repository, and service bus; each summarized as follows. Application frontends use the business processes and services within the system. A service consists of implementation, service contract, functionality and constraint specification, and service interface. A service repository stores service contracts. A service bus connects frontends to the services.

A service-oriented architecture is a style of design that guides all aspects of creating and using business services throughout their lifecycle (from conception to retirement). An SOA is also a way to define and provide an IT infrastructure to allow different applications to exchange data and participate in business processes, regardless of the operating systems or programming languages underlying those applications.

In the case of the public sector, SOA, as an integration concept, not only gives connectivity to various heterogeneous IT systems but also enables close coupling of administrative requirements with the various technologies underlying them. Such a move away from a pure technology integration approach to the holistic standpoint of SOA-Governance, involving as it does organization-wide administrative and technological transformation from purely task-oriented thinking to a service-oriented approach, represents a major innovation in terms of classical Enterprise Application Integration (EAI) concepts.

On the technical side there is a coordinated set of international standards which most vendors already support. These standards aim to improve the interworking of heterogeneous software systems for the realization of cross-departmental business processes and to drastically cut integration costs which are now prohibitively high. SOA is based on established internet protocols and information models like HTTP and XML, extended by other standards. One key paradigm here is service orientation which is based on Web service technologies and allows "loose" coupling of heterogeneous IT components over open service interfaces.

Figure 3. **Overview of the main open SOA standards**



(Source: *Zechner., 2007: 13)*

The functions, process flows, data formats and costs of the autonomous services are known to the outside whilst the details of component implementation are not. In this manner platform independence and service interoperability are both assured. Orchestration (composition of process sequences) of the loosely coupled services can be carried out using a process description language such as BPEL (Business Process Execution Language).

The Extensible Markup Language (XML) developed from the need to improve the functionality of Web technologies through the use of a more flexible and adaptable means to identify information. As a metalanguage, XML is used to describe other languages, providing the facility to define tags and the structural relationship between them. As a result, developers can create their own customized tags in order to define, share, and validate information between computing systems and applications.

2.1.2 Web Service Technology in support of an interoperable eGovernment

In more technical terms, a service is a program that interacts with users or other programs via message exchanges, and is defined by the messages not by the method signatures. Web services technology is defined as a systematic and extensible framework for application-to-application interaction built on top of existing web protocols.

These protocols are based on XML and include:

- Web Services Description Language (WSDL) to describe the service interfaces,
- Simple Object Access Protocol (SOAP) for communication between web services and client applications, and
- Universal Description, Discovery, and Integration (UDDI) to facilitate locating and using web services on a network.

SOAP is an XML based protocol for messaging and remote procedure call using HTTP and SMTP. It defines how typed values can be transported between SOAP representation (XML) and application's representation by using XML schema definition. It also defines where various parts of Remote Procedure Call (RPC) are defined, including object identity, operation name, and parameters.
WSDL has an XML format that describes web services as a collection of communication end-points that can exchange certain messages.

A complete WSDL service description has two parts:
i) web service description (abstract interface), and
ii) protocol-dependent details (concrete binding) that users must follow to access service at a service end- point. UDDI is an XML based standard that provides a unified and systematic way to find service providers through centralized registry of services. BPEL is a language for specifying business process behaviour based on web services. These processes export and import functionality by using web service interfaces. Web services are widely adopted as standard technology for implementation of service oriented architecture (SOA).

2.2 Implementation of information technologies within public organisations

In accordance with the national strategies for development of the public sector, the 2nd District City Hall in Bucharest has implemented, in collaboration with Advanced Technology Systems from Târgoviste, an integrated information system for eAdministration.
The components of the IIS support the electronic activity within the departments of the City Hall, comprising dedicated applications such as:

- Document Management and Electronic Archive
- Taxes and Fees Management
- Finance and Accountancy
- Investment Management
- Stock Management
- Human Resource Management
- Urban Administration and Planning
- Contraventions
- Information Vocal System for the Citizens
- Public Relations
- Managerial Scoreboard

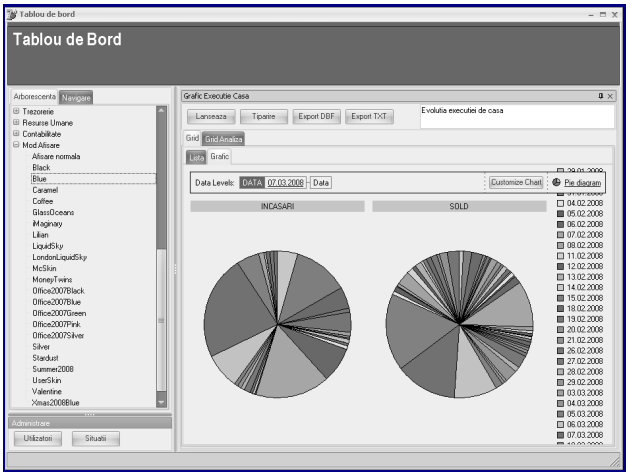
The Integrated Information System (IIS) answers to the requirements defined by any of the departments of the public organisation, and indexes all the types of data and information within the public organisation, as to provide correct, complete and real-time information to decision-makers.

The large amounts of data and information collected within a public organization require that the management of data and of information become a central component of an IIS. Information coordination and management represent a strategic issue of major importance. The Document Management application assures the control, the organization, the access and the publication of the most important information of the City Hall, in an accessible and efficient manner.

Through this application, the public servants from all the departments of the City Hall can obtain correct, complete and integrated information in real-time.The IIS comprises business intelligence solutions to provide all the functionalities required for the identification, integration and analysis of data from heterogeneous, semantically different sources, so that the decision-makers can improve the quality of the decisional process.

The decision-makers within the City Hall can define and use a adequate set of economical indicators to obtain timely information. The managers can obtain reports on the evolution of the main indicators concerning the fulfilment of the objectives, evaluation of costs and incomes, etc. The user interface is designed to present the data in an easy access and intuitive manner. When using the scoreboard, the manager can display or hide sections that present different business intelligence components.

Figure 4. ***Managerial Scoreboard***



(*Source:* ATLAS^{TM}2008)

Another important component of the IIS is the Taxes and Fees Management application that allows citizens not only to access online information about the taxes and fees due, but also to make the payment using Internet Banking Services. Thus, the services are free for taxpayers, and are available 24/7, offering significant benefits to the 2nd District taxpayers.

The main features of the application:

- Flexibility: the calculation mechanism of taxes and fees can be defined or modified, in order to update it to the changes of legislation.
- Advanced Search Engine: based on search criteria defined by the user; the search is case sensitive, fast and accurate.
- Personal Report Generator: the lists depend on user's options.
- High security level of data and transactions: the security policy used throughout the application is based on privileges assigned to either users or groups. The security policy is similar to that used by Windows NT / Active Directory because the application can be configured to integrate in the domain and utilize the same users and groups defined at a domain level.
- Data Recovery and Conversion: the data can be imported from a previous system used by the customer.
- Interface facilities and functionality.

To use this electronic mean of payment, the taxpayers need to address to the Local Budget Income Direction within the 2nd District to create an account and an access password. As the user, the taxpayer can choose to be periodically informed in

regard to the contributions due. As some of the citizens do not have the IT skills to use an online application or do not have Internet access, the taxes and fees can be collected through online payment carried out at post offices. 67 Post Offices in Bucharest (each with 2-4 work stations) are connected online to the Local Budget Income Direction of the 2nd District, being able to consult to the taxpayers' database and facilitate the payment of the taxes and fees. This solution has proved to have a greater impact than Internet payment because it addresses a larger segment of population.

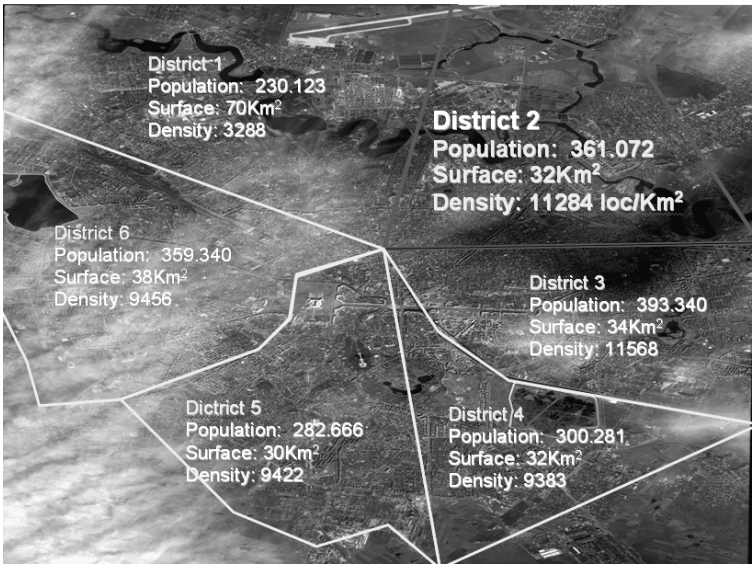
3. INTEROPERABLE ESERVICES BETWEEN THE 2ND DISTRICT CITY HALL AND THE BUCHAREST GENERAL CITY HALL

To exemplify the foregoing, based on the components of the integrated information system (ATLAS™2008) implemented within the 2nd District City Hall and the Bucharest General City Hall, this paper presents an interoperability scenario between the taxes and fee application and the GIS module.

3.1 The Setting of Interoperability

According to the National Institute of Statistics (ASR 2006), the city of Bucharest has a number of 1.931.236 inhabitants, distributed as follows within the 6 districts of the municipality:

Figure 5. **Districts of Bucharest**



(*Source:* ATLAS™2008)

The taxes and fees application represents an important part of the integrated information system, as it addresses the collections that form the budget of a public institution. The application allows citizens to access online information regarding the taxes and fees due and also to pay them directly on the web site of the public institution, at a bank, an ATM or POS.

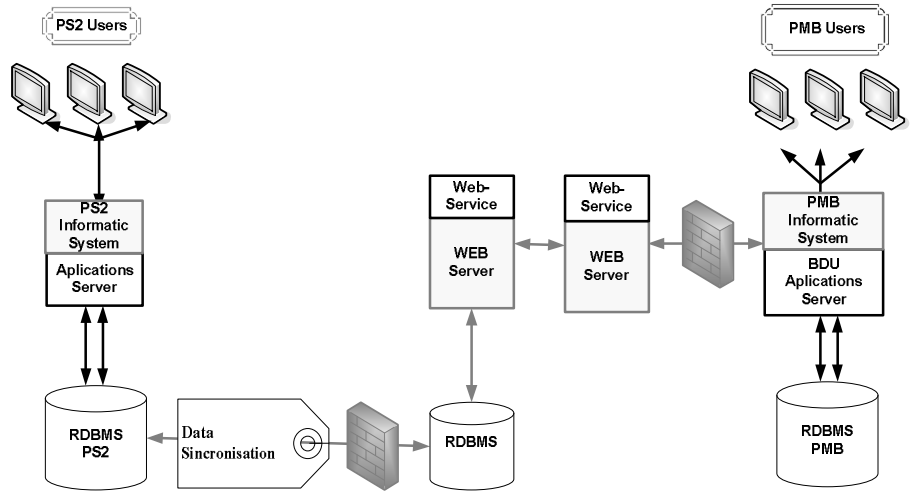
Information sharing across the public sector is essential in order to make the best use of its information assets and reduce redundancy and bureaucratic structures within public administrations (Stefan, 2008). In this context, Geographic Information Systems (GIS) have become indispensable to effective knowledge transfer within the public sector. Geographical Information Systems (GIS) represent an important part of the mainstream management operations in public organizations, being integrated into their daily operations and used for a variety of activities from infrastructure management to site selection, research and analysis.

Under the umbrella of convergence and within the tendency of implementing business concepts into the public environment, this paper brings forth the trend of extending business intelligence with geographic information systems, by proposing a framework for processing the collection and creation of knowledge within public administrations.

3.2 Case study: The exchange of geospatial data

The interoperability scenario that the author proposes in this paper allows the local public administration institutions presented above to easily share and exchange data between the taxes and fees application.

Figure 6. **Architecture and functionalities of geospatial data exchange**



(*Source:* ATLAS^{TM}2008)

The example presented here take part of the integrated information system implemented within the 2nd District City Hall, and the Geographical Information System implemented within Bucharest General City Hall. The paper presents several scenarios for data interoperability, based on this example.

3.2.1 Scenario 1 - Change of property data

In the last years, among the priorities of the Bucharest General City Hall and of the 2nd District City Hall was the implementation of an integrated information system for the management of the activities of the administration, in order to provide integrates access of all the existing data, to answer to the requirements of all departments and to assure correct, complete and real-time information to decision makers.

At the moment, there is no connection between the geospatial databases of Bucharest General City Hall and the taxes and fees application of the 2nd District City Hall, and therefore the update of data in one database is not automatically performed in the other database. For this reason, citizens have to present the documents related to a property change to both institutions, so that the corresponding changes can be made in each of the databases.

This practice presents several disadvantages, such as:

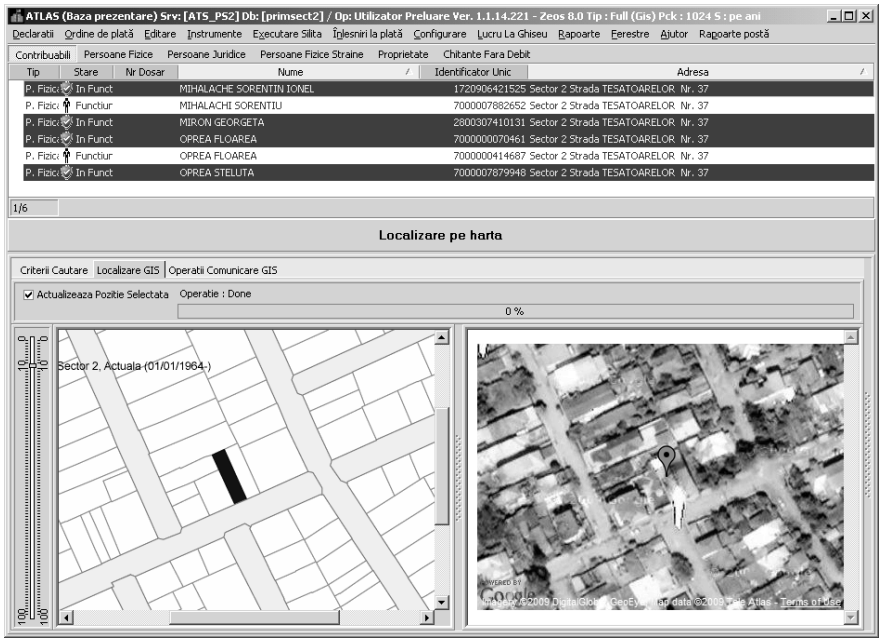
- It increases bureaucracy by requiring the citizens to submit the documents to both public institutions. The citizen first goes to institution A where he files his request. He then has to go to institution B to file the same documents and wait for a response. After receiving the response, he has to go back to institution A, where he attached the response he got from institution B, and waits for the final acceptance from institution A. This procedure proves very costly in terms of money and time for the citizen.
- Compared to an interoperable system, this solution implies a higher cost associated with processing the citizens' request, by incurring additional labour and material costs, and it also makes the document workflow more complicated.
- Public servants have to take into account what happens if the citizen forgets to submit the documents to the other institution, or submits different documents at one of the institutions. How does the public servant check if the data contained in the database he has access to, is consistent with the data present in the other database?
- It increases the risk of data inconsistency between the two geospatial databases. Inadvertently, the public servant could make a mistake and input wrong data into the system. Because data is introduced twice, the risk of human error is doubled.

If we are to consider a scenario where a tax payer that lives in the 2nd District sells a property, all the changes related to this transaction shall be registered in the taxes and fees application and made on the GIS Map of the 2nd District City Hall, without being automatically updated on the GIS Map of Bucharest General City Hall. The taxpayer has the responsibility to submit the same documents concerning the sale to Bucharest General City Hall.

Interoperability provides the solution through which both databases can be updated automatically and always kept in synchronization. When a change occurs in one of the databases, the system is able to detect it automatically and submit it to the other database as well. All these operations are transparent to the public servant and do not require any additional training.

Step 1: Upon of completion of the sale, the taxpayer submits the related documents to one of the local public institutions concerned.
Step 2: Because the public servant has access to geospatial data from both databases, s/he is able to easily check the status of the property in question.
For example he could check to see if all taxes and fees are paid for the property, or check if data submitted by the citizen is consistent with data stored in the database.

Figure 7. **Joint view between the taxes database and GIS**



(*Source:* ATLAS™2008)

Step 3: If no problem is identified, the public servant introduces the changes in the geospatial database.

Figure 8. **Identifying a property on the GIS Map**

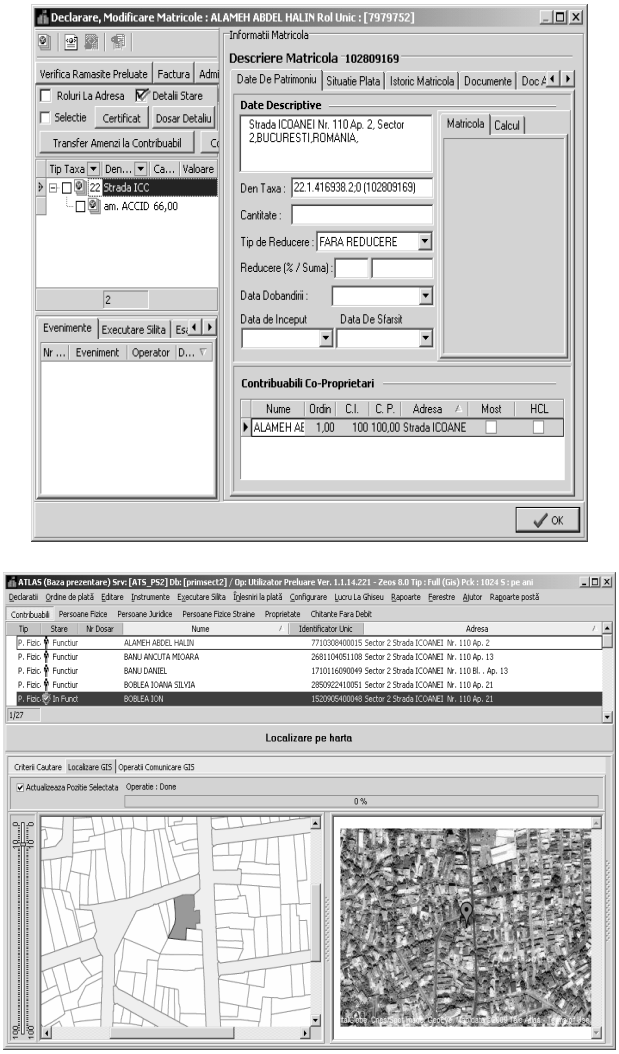
(*Source:* ATLAS^{TM}2008)

Step 4: Upon saving the information into the database the system starts a new transaction and transmits data about the change to the paired web service.
Step 5: Using the data received, the receiving web service performs an update to the database and notifies back the other web service about the result of the update.
Step 6: In case all update operations were carried out successfully in both databases, the system finalizes the transaction. Otherwise, if there were any errors encountered during processing, the transaction is rolled back so that no incomplete changes are made in either database, and the public servant is notified about the problem.
Step 7: The data is now available in both systems for future use.

3.2.2 Scenario 2 - The fiscal inspector does routine property checking

Within the public administrations fiscal inspectors carry out routine checks to ensure that citizens are correctly reporting their property data. Without an interoperable system, inspectors have to request further information from the Bucharest General City Hall for property data every time they identify a possible tax evasion. This proves a tedious and time consuming process, and because of this inspectors are unable to identify all tax evasions, and are only able to find a small number of them.

Figure 9. **Checking the consistency between fiscal data and GIS databases**



(*Source:* ATLAS™2008)

When using the interoperable system, the fiscal inspector has access to real time data about properties. He is able to locate a property on the GIS map, identify it visually and easily identify if there is a discrepancy between the property area declared and the actual property area. He can also request a satellite view of the property to look for additional buildings or features not declared (i.e. swimming pool).

3.3 Value-added services and capabilities of interoperability for public administration, citizens and businesses

Connectivity and interoperation among computers, among entities (governments, businesses, citizens, and individuals), and among software components can increase the flexibility and agility of ICT systems, thus reducing administrative and software costs for government. They may also reduce the time needed to implement software and e-Government services.

- At a EU Member State level, EGovernment flexibility and agility may be increased as interoperability increases. Interoperability can, for instance, assist in the delivery of e-government services based on life events, and help the business sector interact electronically with administrations, reducing administrative costs burden and encouraging SME's to "go digital".
- At the European level, interoperability supports the Single Market and its associated "four freedoms of movement of people, capital, goods and services". As people move and enterprises trade across Europe they need to interact electronically with public administrations in Member States other than their own. For eGovernment services to be usable across border, national administrations will need to obtain information from other Member States (e.g. relating to taxation status, social welfare contributions, registration information on enterprises, etc.). Since the Single Market and other key European policy objectives require interoperability between European administrations, the needs of trans-border users of eGovernment services must be taken into account when developing eGovernment services.

3.3.1 Government Benefits

Through implementing interoperability frameworks there are many benefits that the Government has the potential to achieve:

- reduced duplication of effort across administrations;
- reduced risk of failure in politically sensitive areas;
- improved efficiency and effectiveness of overall Government service delivery;
- shorter time frames to develop and negotiate collaborative service arrangements.

3.3.2 Customer Benefits

Through the implementation of interoperability scenarios, there is the potential for the customer to receive many benefits. Through the administrations reaching across traditional boundaries, the service delivery becomes more customer-centric.

Therefore, rather than customers or citizens having to respond to bureaucratic processes/requirements, administrations are now seeking to improve service delivery so it is responsive to customers' needs. The potential advantage of interoperable service delivery is the enhancement of the customer experience. Specifically, these benefits may include the following:

- increased customer satisfaction levels;
- the customer's needs and priorities are better addressed;
- relieving the customer of the need to navigate through the structural complexity of administrations to receive services;
- improved quality and flexibility of customer experience across administrations; and
- Government becomes more seamless and accessible to the customer.

3.4 Benefits of using information technology

Information technologies improve significantly the quality of the relationship *public administration - citizens – businesses*, providing low cost and efficient interaction. Modern information technologies, such as XML, Web Services, SOA, WSDL and UDDI, support the quantitative and qualitative development of electronic public services (ISP XML 2009).
XML (Extensible Markup Languages), as a metalanguage, provides interoperability between data managed by systems developed with different architecture and programming language (Mulberry Technologies, 2009). Among the benefits of XML, the author presents the following:

- Simplicity, as information coded in XML is easy to read and understand, and it can be processed easily by computers.
- Openness, as XML is a W3C standard.
- Extensibility, as there is no fixed set of tags, and new tags can be created as they are needed.
- Self-description, as XML documents can be stored without schemas because they contain meta data.
- Contains machine-readable context information, as tags, attributes and element structure provide context information; this creates new possibilities for highly efficient search engines, intelligent data mining, agents, etc.
- Separates content from presentation, as XML tags describe meaning not presentation.
- Supports multilingual documents and Unicode, an important feature that supports the internationalization of applications.
- Facilitates the comparison and aggregation of data, as XML documents have a tree structure they can be easily compared and aggregated.

- Can embed multiple data types, from multimedia data (image, sound, video) to active components (Java applets, ActiveX).
- Can embed existing data
- Provides a "one-server view" for distributed data, as XML documents can consist of nested elements that are distributed over multiple remote servers; the World Wide Web can be seen as one vast XML database.
- Popularity, as it has been rapidly adopted by industry

Web Services based interoperability provide several technological and business benefits, a few of which include:

- Application and data integration
- Versatility
- Code re-use
- Cost savings
- Increased data security

CONCLUSIONS

As the current development of public administration changes from a task oriented to a more process oriented organization, interoperability becomes the key enabler for modern eGovernment. Interoperability represents a robust solution for delivering public value by providing complex and efficient online public services for citizens and business.

Within the context of the adoption of the European Interoperability Framework by the European Union leaders and the necessity to implement it within Member State administrations, this paper details the new dimensions of the virtual public environment, and the information technologies that sustain the development of the interoperability mechanism between administrations, providing several scenarios of implementation at national and European level.

The case study the author has detailed presents a system for data exchange between the taxes and fees management application implemented within the 2nd District City Hall and the Geographical Information System used by Bucharest General City Hall. The implementation of an interoperability solution translates into benefits for the local public administration, the citizens and the business environment in terms of cost, efficiency and reduced bureaucracy, creating new functionalities and qualitative features.

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