A FRAMEWORK BASED PROTOCOL FOR A BETTER INTEROPERABILITY AMONG SERVICES IN E-GOVERNMENT

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ABSTRACT

In order to improve the efficiency and quality of services provided to citizens (and/or businesses), Public Administrations (PAs) are constantly trying to turn their services into electronic-oriented ones (e-Government). Achieving interoperability and security in this area is a challenging task. In this paper, we define a middleware to ensure the interoperability of the information systems in the domain of e-government, while guaranteeing some security properties. We propose an applicative protocol integrated in the middleware. A case study was developed to validate the suggested framework.

Keywords: *E-Government, Interoperability, Services, Middleware, Protocol*

1. INTRODUCTION

For some years now, governments have entered an era of cogitation regarding the future of public service provision. Among the prominent issues in the political agenda stands the modernization of public agencies and service optimization for citizens, businesses and government employees. In this context, electronic government (for, e-government) has come into serve these objectives.

Electronic government is the provision of electronic information and services for citizens and businesses and among government agencies. This electronic advent of government, which faces complex challenges [1], offers new access levels to government information and services [2]. Sprecher [3] considers e-government as a technology to simplify and mechanize transactions between governments and constituents, businesses, or other governments.

Also, Meho and Haas [4] believe that governments should employ new information technologies in order to locate their government information appropriately.

The domain of e-government is an example of domain ridden by problems.

One of the problems that interest us is the interoperability between different public administrations.

Moreover, interoperability is a key issue in the development of current e-government services. Various sources agree on the definition of interoperability considering it as the capacity of various types of networks, computers, operating systems, business applications, software or services (data-processing or not) to work together by using specifications, languages and common protocols, and to give access to their resources in a reciprocal way [5]. In other words, the interoperability must ensure the data-processing programs that are based on the exchange of information and the mutual use of information which has been exchanged.

It consists of making function heterogeneous systems together. It is also considered as a fundamental requirement to share and re-use knowledge between networks, and re-organise administrative processes to better support the services themselves [6].

For this, interoperability among Public Administration agencies has been identified as a central issue and a critical prerequisite for the effective functioning of contemporary PA systems [7,8,9,10,11,12].

European Interoperability Framework defines three interoperability types at the technical, semantic and organizational level [7].

The first one refers to the topics of connecting systems, defining protocols and data formats.

The second one, concerns the exchange of information in an understandable way, whether within or between administrations, either locally or across countries and with the enterprise sector.

The third level refers to enabling processes to co-operate by re-writing rules for how Public Administrations work internally, interact with their customers and use ICTs.

Improved interoperability among public organizations and between public and private organizations is of critical importance to make electronic government more successful [13,14].

Also, we can't speak about e-government and interoperability without approaching the concept of security.

In this paper, we deal with the problems of the interoperability, by describing a protocol that defines a mechanism based on an architecture of reference, which materializes the interoperability. This architecture, integrates a component ensuring the data exchange between the different PAs. This communication must be secure.

We propose a middleware named EGM (for, Electronic Government Middleware) that ensures the data exchange between the interoperable PAs of the e-government. Also, the EGM ensures the security of the data exchanged between the different PAs.

Two levels of communication are defined. The first one is between the client and the host; the second one is between several servers, while exploiting the middleware to solve the problem of interoperability.

The paper is organized as follows: in section 2 we provide some related works. In section 3 we present some aspects of the suggested approach and in section 4, we present the mechanism of the communication based on the EGM by specifying the EGM commands and headers. Some aspects of implementation are provided in section 5. The final section contains our conclusion and some perspectives.

2. SOME RELATED WORKS

Many e-government projects were developed and various approaches were proposed to ensure interoperability which can be achieved via various mechanisms. One way to achieve interoperability is by using information systems from a single administration [15]. These systems will most probably be able to perfectly exchange information with each other, by means of a proprietary interface between the systems. But, as the current IT of the public sector is very heterogeneous, and the sector is characterized by different systems, this is not a realistic solution [16].

Moreover, single-vendor interoperability will not contribute to supply independence because the use of proprietary interface by another administration is usually a costly and complex process. Another mechanism to achieve interoperability is the use of open standards [17]. Standards are about collectively agreeing on the specifications for the interfaces between application, services, systems and networks that interact. Open standards differ from proprietary standards because participating in the process of developing, using and maintaining such a standard is in principle open to and freely accessible for everyone. The Dutch government has chosen open standards above proprietary standard, mainly to achieve interoperability within its IT architecture.

The eGOV project [18] proposes an architecture to enable 'one-stop government', in order to describe services a mark-up language (GovML) has been developed. GovML defines a set of metadata to describe PA services and life events. The FASME approach [19], focuses on supporting citizen mobility across European countries by the integration of administrative process. In order to satisfy this objective a smart card is provided to citizen for the storage of all personal information and documents; services are delivered through dedicated kiosks.

The EU-PUBLI.com system [20] defines a Unitary European Network Architecture; it proposes a middleware solution to connect heterogeneous systems of different public administration and to enable a service-based cooperation between public administrations.

The open and standard exchange protocol "Protocole d'Echanges Standard et Ouvert" (PRESTO) [21] specifications along with clarifications, amendments, and restrictions of those specifications that promote interoperability. Protocols such as eLINK, FAST and ebMS2 are very known.

Such projects demonstrated the feasibility of interoperability technologies in e-government, but they did not explore the possibility of introducing a protocol based on the architecture of reference TCP/IP to ensure interoperability, security and the transparency of the institutions.

In this paper, we are interesting more particularly in the interoperability aspects by defining a middleware that takes into accent some aspect of security. This approach includes two modes of communication: between the client and the host on the one hand; and between several servers on the other hand.

3. OVERVIEW OF OUR APPROACH

The approach presented in this work defines a middleware to ensure the interoperability between PAs of the e-government. It is based on certain characteristics that we will define and offers several advantages which we will quote in the following sections. The mechanism we propose ensures the interoperability of the information systems representing the public administrations which offer the services of the e-government. The principal objective to reach through this middleware is to deal with technical interoperability between the different PAs by exchanging the data and to ensure security. The transparency of the institutions is ensured in its turn. Security is regularly pointed like the most important brake in the development of the e-government.

The global architecture exposed in figure 1 is an infrastructure using the EGM. It represents a protocol (set of rules) based on the model of reference TCP/IP, which facilitates the installation of the interoperability.

TCP/IP has the advantage of being standard. It is seen as a product tested for a long time in a distributed and heterogeneous environment, free and independent of manufactures. Considering these advantages, we define a new protocol based on the TCP/IP. This protocol guarantees the interoperability and must ensure the security so as to refuse the access to the intruders.

EGM is a middleware that ensures interoperability by exchanging the data and by respecting their format, thus to obtain the adequate answers to help the citizens. This protocol is on the client level and the host one.

It should be known that the agencies (physical counters) of the public administrations which belong to the same branch of industry are all connected (centralized) to the same host (figure 2). Consequently, they share the same data-base. The approach used is similar to the architecture of the bus communication JAVA-RMI (Remote Method Invocation). In this architecture, there are the skeleton host side and the stub client one [22].

The problem of interoperability arises between the various distributed hosts. We use EGM component to provide the communication between the different hosts.

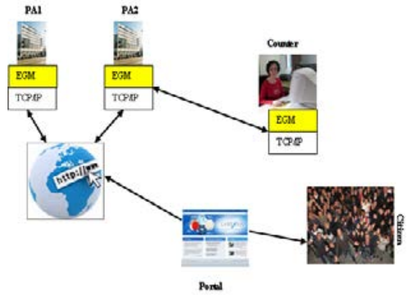


Figure 1: Interoperability Between Various Pas

When a citizen presents himself to a counter for a given service, the EGM protocol (client side) is used by the counter (PA) in order to obtain information about the citizen by exchanging the data between hosts. In this case, and after the authentication of the PA near to the host, the EGM protocol (client side) collect all necessary information by sending the request to the host with an adequate EGM syntax. The receptor host tries to find a response while following a specific mechanism to the EGM protocol (host side). If the answer is not available in its local data-base, there will be interoperability between the existing hosts. This protocol regulates many problems such as: the data exchange, the solution to the problem of heterogeneity, flexibility, interoperability and transparency of institutions.

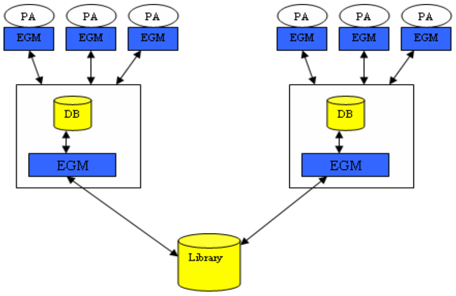


Figure 2: The Use Of The Library By The Pas

The citizen can directly reach the portal of the government via Internet and select the service which he needs (according to the life events). The type of the selected service enables him to be connected directly with the host of the administration that offers this help.

We should take into consideration that the HTTP protocol is present in our approach and in which all the advantages remain available. We will use it in the exchange of the web page. Owing to the fact that it is regarded as a standard, it will facilitate the installation of the interoperability mechanism. The implementation of the technical interoperability, uses the EGM component based on TCP/IP and while following a certain mechanism.

4. THE EGM COMMUNICATION

Each protocol has its own mechanism of communication and its own syntax of the exchanged messages. For a well understanding of the mechanism of our middleware, we must initially specify the format of a EGM request and answer.

The EGM request is subdivided in two parts. The first part is the command. The second is the header. The command can be one of the commands defined by the EGM protocol. In our earlier works [23] we have explained the use of various commands. The header part is made up of several fields whose form is always the same one. The name of field followed by sign of equality (=) and the value that each one wants to associate with him. The fields can be of various types according to the associated use. Its value is that one which was seized by the civil servant of the PA counter. The two parts of the EGM request play an important part to ensure the interoperability when it is necessary. It consists of a format composed of several same lines. Each line corresponds to a field which was required by the request of the client follow-up of the sign (=) and of the value of the field which is in the data base of the associated host.

In the following section, we explain the two parts: the commands and the header of the EGM protocol.

4.1 The EGM Commands

The dialogue between the client and the host or between several hosts is established by exchanging various EGM commands. The PA must be initially authenticated near the host to be able to send its request. It uses the command "CONNECT" in the command part, its password and identifier in the header part. This PA establishes its EGM request and sends it to the host to that it is connected (step 1). This last, tries to find the response in its LDB (Local Data Base). In the mechanism of the EGM, the command is initially sent followed by the header of the request. EGM reads the first part which is the command (step 2). If the latter is not recognized for it, it tries to find its equivalent while reaching the library (step 3). This library consists of several lines, where each one contains either the equivalent of a command, or the equivalent of a field of the EGM header request. The EGM (client side) will cross the library while trying to find the equivalent of the command. For more security, if it does not exist, an error message is sent to the client (step 4) (see figure 3). In the opposite case, the equivalent of the command will be transmitted to the component. Thereafter, the header part will be analyzed in its turn.

In order to supplement information provided for citizen, the host finds itself in the obligation to send requests to the other distributed servers. For that, it uses the format of an EGM request. It must be initially authenticated near the host using the command “CONNECT” in the command part, the password and its identifier in the header part, then it can send the request to supplement missing information of the citizen. Once the command part is transmitted, it is analyzed by the EGM protocol.

If it is not recognized by the EGM host side, it will try to find its equivalent in the library, and we will apply the mechanism between the client and the server considering previously. So, we have interoperability between the different hosts. When information is found, it will be transmitted to the petitioning server which will gather all information and send them to the client (EGM client side) that posts them on the interface.

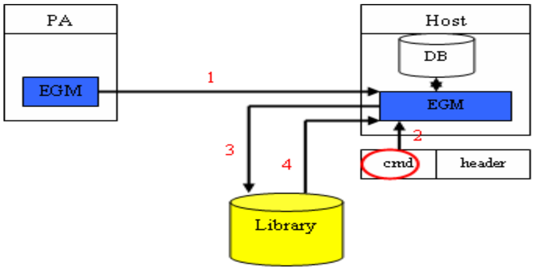


Figure 3: The Mechanism Of The Commands EGM

4.2 The EGM header

Once the command is defined by the host (EGM host side), it passes to the treatment of the header part. The header part is made up of various fields. They are different according to their cases from use. We consider two cases of action : consultation and modification.

4.2.1 EGM consultation

The EGM consultation is carried out by using one of the commands defined by the protocol like : GET(*), GET (firstname), GET(secondname)…. We use the number of citizens as a field of the header part named “number”. It is seen as the identifier in all PAs and it is single. Generally, it is provided by the electronic card of the citizen for the reason of security. The EGM of the PA recovers this number to find all information on the citizen and of which the PA has the right to consult and to respect the private life of the citizens. This number is represented differently in various DBs (according to the branch of industry). For example, the attributes 'Idpatient' in the DB of the hospital, 'Idcitizen' in the DB of the commune and so one and so forth. For this, the EGM host side reaches the library to find the equivalent of the field "number". Once recovered, it will be treated by the EGM server side and thereafter sent to the EGM of the PA side.

4.2.2 EGM modification

The EGM request uses various commands in the first part of its syntax. One of the commands used which allows it to modify and to manage information is "Modify" or "change". This request will be treated by a different mechanism (see figure 4). The field of the header part of this request will be recovered by the EGM server side.

This last, reaches the LDB while trying to find the attribute corresponding to the field of the request.

If this last is in the data base, then it will substitute the value of the attribute which corresponds to it.

In the reverse case, where the field of the header does not correspond to any attributes of the data base, then EGM host side reaches the library while trying to find its equivalent. Once found, it will be transmitted to the host and analysed by the same protocol explained in the previous paragraph.

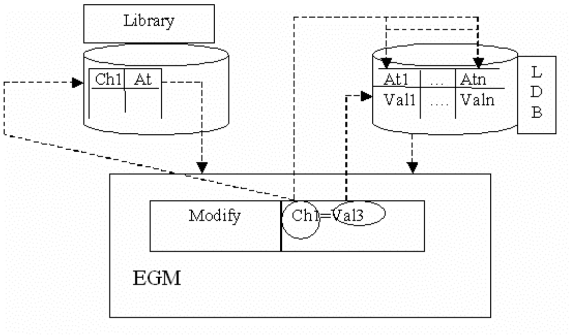


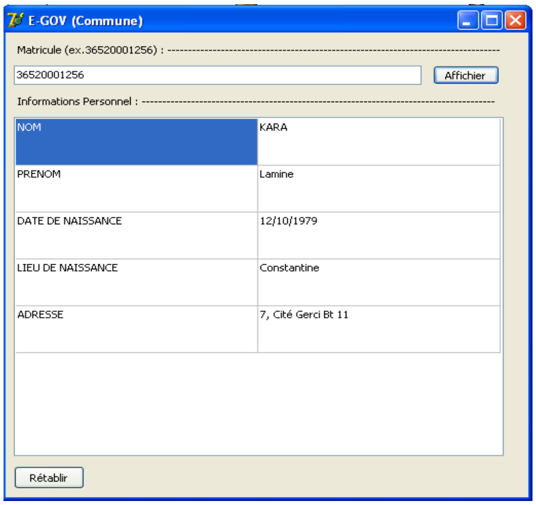
Figure 4: The Mechanism Of The EGM Modification

In the case of communication between several servers, the first operation is the authentification of the host. So, we can refuse the access to its LDB by rejecting the command ''Modify''. In order to validate the mechanism of this protocol, we provide a case study and some aspects of implementation, in the following section.

5. AN EXAMPLE OF SOME ASPECTS OF IMPLEMENTATION

We illustrate the implementation of our middleware via an application of a scenario. The end-user can be a citizen or a PA. We use three types of hosts: a host of the communes, a host of hospitals, like that of various police forces. Each one of these hosts centralizes a whole of PAs which are associated to it and can interoperate. We suppose that the three data bases are heterogeneous and non-redundant: that of the commune is developed in Access and that of the hospital as well as police force in MySql (relational). The fields of these various data bases are non redundant. In our suggested application, the citizen presents him-self at the level of the commune (physical counter) for a given service a birth certificate. For that, EGM component PA side sends a request composed of two parts. The first part is the command GET(*) which makes it possible to gather all information relating to the citizen starting from his number provided by its electronic identity card (see figure 5). The second part is the header made up of the field number. When the request is received by the EGM host side of the commune, this last reaches the LDB and thus it sends all the contents of this base to the physical counter. It should be known that the order GET(*) was recognized by the component EGM host side. This last, has the right to reach the LDB. Another citizen presents himself at the level of the physical counter of the hospital for a given service blood group. The EGM client side of the hospital sends a request made up of the command GET(*) and the header consists of the field number with its associated value. When the EGM (hospital host side) receives the request, it founds itself in the obligation to send another request to the host of the commune which supplement missing information. This command will be received by the EGM of the commune (host side), but it has no meaning for it. So, it reaches the library to try to find an equivalent for this command. The equivalent of GET(firstname, secondname) in the library is GET(fisrtname,familyname).

This command is sent to the server of the commune that will obtain the first and second name of the citizen. This information will be sent to the host of the hospital that, thereafter, gather all information and send them to the counter of the hospital that posts them (see figure 6).



E-GOV (Commune)

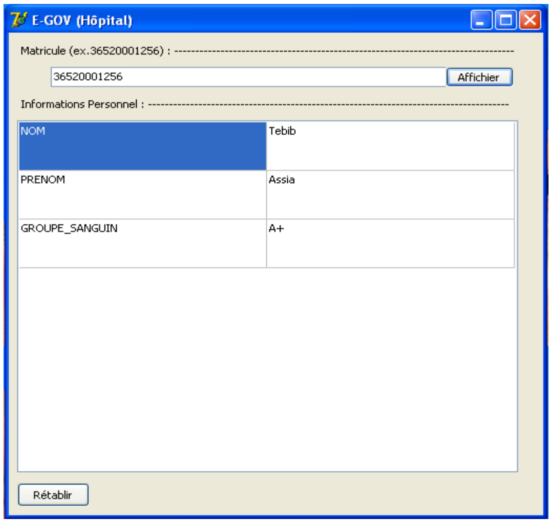
Matricule (ex.36520001256) :

36520001256

Informations Personnel :

NOM	KARA
PRENOM	Lamine
DATE DE NAISSANCE	12/10/1979
LIEU DE NAISSANCE	Constantine
ADRESSE	7, Cité Gerci Bt 11

Figure 5: The interface of the commune



E-GOV (Hôpital)

Matricule (ex.36520001256) :

36520001256

Informations Personnel :

NOM	Tebib
PRENOM	Assia
GROUPE_SANGUIN	A+

Figure 6: The interface of the hospital

We notice that there is interoperability between the two hosts, that of the commune and the one of the hospital.

The interfaces of the various PAs are ergonomic and simple to use. There is a button (to post) which is used to obtain adequate information with the number read from electronic identity card of the citizen. A button (to restore) allows one to initialise all the fields of the interfaces.

6. CONCLUSION AND PERSPECTIVES

We presented in this work a middleware that permits interoperability between PAs of the e-government while solving the problem of the interoperability which limits the installation of the e-government system. We set up an applicative protocol baptized EGM (for, Electronic Government Middleware). This last, has been added to the application layer of the architecture TCP/IP. It has the advantage of being a standard which facilitates the installation of interoperability. It is also used in the distributed and heterogeneous environment, free and independent of manufactures. EGM is used in a distributed environment that the commands employed are simple and facilitates the data exchange between the different PA. Certain of these commands have the equivalents put in the library. Some commands are rejected for reasons of security. This library consists of several lines, where each one contains either the equivalent of a command, or the equivalent of a field of the EGM header request. Some interfaces of the PA were made while being based on ergonomic aspects to make them easier to be used by the persons in charge for the physical counters. Our next work will consist in harmoniously supplementing the public portal of the e-government which provides services to the citizens being anywhere in the world. We will also integrate an ontology for capturing more concepts about the e-government domain and life events. Further life event and services descriptions will be integrated into the portal and a real one stop portal will be developed.

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