Electronic Document Management in the University of Murcia

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1. EXECUTIVE SUMMARY

The recent publication in Spain of the *Law 11/2007, concerning Electronic Access of Citizens to Public Services*, establishes a suitable regulatory context in which Public Administrations are able to simplify their internal processes and offer electronic services to citizens with all the legal guarantees. Different articles of this law stress the importance of an appropriate management and preservation of electronic documents and dossiers, through the use of standard formats and the storage of this electronic information in digital archives, with the objective of making the interoperability between Public Administrations easy. In this paper we are going to describe several initiatives that the University of Murcia, within the *Electronic Government Project*, is designing and developing in this sense, with the aim of avoiding the use of paper and simplifying its internal processes.

First, we are going to analyze four new services deployed to the Electronic Government infrastructure of the University: a service in charge of generating printable copies of an original electronic document, a service that supplies the role played by a civil servant in a specific procedure, a service that checks the validity of documents and, finally, a service that provides an interoperable way to access electronic documents. These services, which are according to the new law, try to standardize the documentary management and provide citizens, in any moment, with information about the processing state of their procedures.

Furthermore, with the objective of providing the University of Murcia with a centralized digital repository for its internal procedures, the University is working on the deployment of a digital archive for storing electronic dossiers and documents. The solution that is being evaluated now is Alfresco, which is an open source tool for the management of digital contents through a service oriented architecture (SOA). In addition to this solution, the University is developing a preservation layer based on an initiative of an IETF working group called *Long Term And Notary Services* (LTANS). This layer tries to generate the appropriate electronic evidences that guarantee the long term authenticity and integrity of the digital objects stored in the electronic archive.

Finally, the University of Murcia is introducing some new electronic procedures. One of them allows the lecturers to publish their electronic exam announcements and exam marks with agility and in wherever they are. Another one, called *Express Payment*, speeds up the financial workflows and the payment processes within the University. All the documents exchanged in these procedures are generated in XML open formats and include electronic signatures according to XAdES specification. These initiatives motivate the internal interoperability in the University and are added to other external interoperability projects with administrations, like the *Ministry of Public Administration* (through the SARA network), the *National Agency for Tax Administration*, or organizations like the *Spanish Confederation of Savings Banks* (CECA).

2. ELECTRONIC DOCUMENT MANAGEMENT

In this section we explain the SOA-based framework that the University of Murcia has designed and developed in order to accomplish the appropriate management of electronic documents within its Electronic Government Infrastructure (Sánchez, 2006). This framework tries to standardize the electronic document management as much as possible with the aim of interoperating within the University, by exchanging internal documents between the different administrative processes (internal interoperability). Moreover, it has the additional objective of exchanging documents with Public Administrations, thus achieving interoperability with external entities (external interoperability). Besides, this framework provides citizens, in any moment, with information related to the processing state of the administrative procedures they initiated against the University.

The aforementioned framework consists of four services: a service in charge of generating printable copies of an original electronic document (a.k.a. *authentic copies*), a service that supplies the role played by a civil servant in a specific administrative procedure at a specific time, a service that checks the validity of documents as well as authentic copies and, finally, a service that provides an interoperable way to access electronic documents stored by the University of Murcia, thus making internal interoperability possible. Additionally, some of these services exchange information by authenticating headers so as to ensure information integrity and access authorization. Next subsections describe each service in more detail.

The following figure shows the relationships between the services that are part of the electronic document management framework.
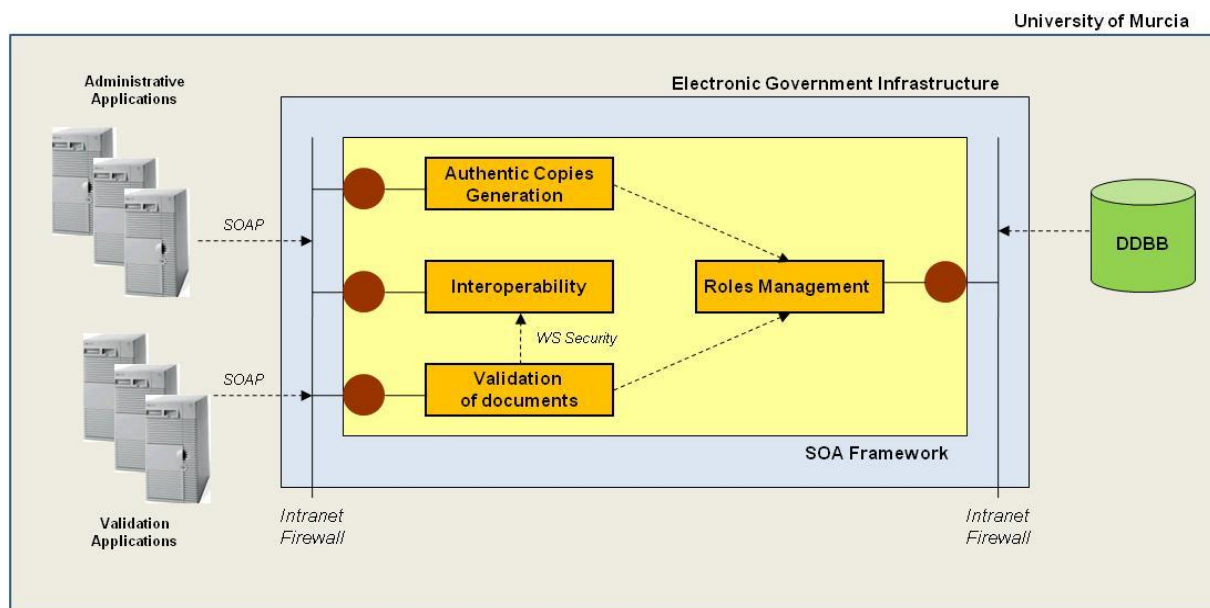

Figure 1. SOA-based framework for the electronic document management

2.1. Authentic copies generation service

Conceptually, as it is defined in Law 11/2007 (Boletín Oficial del Estado, 2007), an authentic copy is an electronic receipt or certificate which is delivered to citizens. This receipt or certificate is created by a citizen, after initiating an administrative procedure, or by the Administration (by a civil servant or as a result of an automated administrative act) after the processing of such a procedure, as a proof of execution.

The electronic receipt or certificate is a printable electronic document generated from the original signed document, which is associated to a specific administrative procedure. It may have or not the same format as the original document. Furthermore, it includes a code that uniquely identifies the original signed document. This code exists together with other information related to the signer,

such as his identification number, his signing role, the signing time, etc., that allows identifying him, in a visual manner, as the signer of the receipt or certificate.

Additionally, the receipt or certificate includes other security features with the objective of guaranteeing its authenticity and integrity, not only in electronic format but also in printed paper. These security characteristics include electronic signatures, secure verification codes (SVC) and barcodes.

As an authentic copy is kept by the Administration, citizens are able to request a specific receipt or certificate as many times as they wish, after its first delivering.

The target of the authentic copies generation service is creating an electronic receipt or certificate from the original signed document, stored by the University or Murcia, and the inclusion of the aforementioned characteristics within that receipt.

This service is used by every application that offers administrative procedures within the University of Murcia.

2.2. Roles management service

The roles management service is in charge of supplying the role played by a University civil servant at a specific moment in time. Among the set of possible roles, we can find academic roles, administrative roles and financial roles. In this sense, the service works in two different ways. On the one hand, it provides the role played by a civil servant at a specific date. On the other hand, it checks if a civil servant played a given role at a specific date. In order to work properly, the roles management service interoperates with the University back office by accessing members as well as financial management databases.

This service is used by the authentic copies generation service to include the signer role within the electronic receipt or certificate. Therefore, this role ensures that the administrative procedure was requested or accomplished by a civil servant with a proper position. Additionally, this service is also utilized by the validation of documents and authentic copies service, in order to verify that the role played by a signer at signing time was the suitable one.

2.3. Validation of documents and authentic copies service

This service validates both electronic documents and authentic copies issued to the University community by the University of Murcia as a result of administrative procedures. This validation is carried out by using the security characteristics included in both types of documents, thus ensuring their authenticity and integrity.

As far as authentic copies are concerned, the validation service uses the information included in these copies in order to validate the original signed document. This document is provided, through the interoperability service, by the application that generated it. Then, the validation service checks the authenticity and integrity of the document. Concretely, it verifies the digital signatures included in that document as well as the qualified certificates used in their generation. Additionally, it checks the validity of the document at signing time by checking that it has not been tampered with, that the signer played the role indicated (by asking the role service), and so on.

Furthermore, once the validation service has checked the validity of a document, it is able to offer additional information related to the processing state of the associated procedure. This information was supplied to the validation service by the interoperability service, along with the original signed document. In this way, a member of the University community is informed about the stage that the administrative procedure he initiated is in.

2.4. Interoperability service

The University of Murcia is composed of a variety of heterogeneous environments, including applications, operative systems, databases, and so on (Sánchez-Martínez, 2007). This fact has leaded us to consider SOA technology along with services that allow these environments to interoperate, thus making possible the document exchange across them.

The interoperability service is conceived to make feasible the exchange of electronic documents and/or other information, related to administrative procedures, between different services existing within the Electronic Government infrastructure of the University of Murcia. This exchange is accomplished by using authenticated headers, as stated in WS-Security standard (OASIS, 2006), thus ensuring the authenticity and integrity of the documents and/or the information exchanged. Authenticated headers also guarantee that the service requesting documents and/or information is allowed to receive them. Similarly, they also assure the receiver service that the documents or information comes from a service that is allowed to send them.

This service is used by the validation service to request documents to every application that processes administrative procedures within the University of Murcia.

3. ELECTRONIC ARCHIVE AND PRESERVATION

The wide deployment of the electronic government services produces large amounts of electronic documents that must be archived and preserved. The University of Murcia is evaluating different archive solutions with the objective of deploying a digital archive for storing electronic dossiers and documents generated in its internal procedures. At this moment, the solution that is being considered is *Alfresco* (Alfresco, 2007), which is an *Open Source Enterprise Content Management* (ECM).

The open source model, which is also encouraged by the University of Murcia, allows *Alfresco* to use open source technologies and contributions from the open source community to improve the solution and get higher quality. It is composed of different products that offer document management, collaboration, records management, knowledge management, Web content management and imaging. Alfresco uses open source technologies such as Spring, Hibernate or Lucene; modern standard such as JSR-168 or JSR-170; Web Services and Java Server Faces. It also offers file system compatibility with Microsoft Windows and Unix-like operating systems.

When an organization manages and archives electronic documents in an electronic government scenario, another important issue that must be taken into account is the preservation of the digital objects, particularly the electronic signatures. This cryptographic information might become weak over time due to improved computational capabilities, new cryptanalytic attacks might "break" a electronic signature algorithm, public key certificates might be revoked or expire, and so on. For these reasons, complementary methods covering potential weaknesses are necessary in order to support a long-term non-repudiation of the electronic signatures. Additionally, the reliable preservation of content across change of formats requires standard solutions.

The University of Murcia is developing a preservation layer based on an initiative of an IETF working group called *Long Term And Notary Services* – LTANS (LTANS, 2003). This layer tries to generate the appropriate electronic evidences that guarantee the long term authenticity and integrity of the digital objects stored in an electronic archive. The main objective of this development is ensuring and proving the existence and validity of data, especially electronic signatures, in a common and reproducible way over a long and possibly undetermined period of time.

4. INTEROPERABILITY

The University of Murcia is focused on different projects in order to provide real interoperability processes inside the University and in its relationship with other organizations. This effort has the aim of avoiding the use of paper and speeding up the exchange of electronic documents. The main initiatives in this area are commented in next sections.

4.1. Inside University

Nowadays the University of Murcia is working in several interoperability projects with the objective of sharing and integrating electronic documents and data between different and heterogeneous applications. The two most important ones are the *Publishing of Exam Announcements and Marks Service* for lecturers and students, and the *Express Payment Service* for the administrative personal of the University of Murcia.

The *Publishing of Exam Announcements and Marks Service* has some important benefits to the university community. First, a lecturer is able to generate the two main official documents (exam announcements and exam marks) related to each one of the subjects he teaches through the e-learning portal of the University of Murcia (a.k.a. SUMA) (Universidad de Murcia, 2005). Then the lecturer performs a digital signature process with a qualified certificate, like the National Identity Card (a.k.a. DNIe) (DNIE, 2007). Afterwards, the students receive authentic copies from these electronic documents via e-mail or SMS notification instantly, so they can know these academic issues without any delay. Moreover, these copies are printed and published on the official notice board of the Faculty in order to provide the students with the choice of the communication channel (physical or electronic). Finally, both exam announcements and exam marks documents can be checked and validated by anybody through the electronic validation service and the interoperability services previously outlined. The following figure depicts the different entities involved in this service.
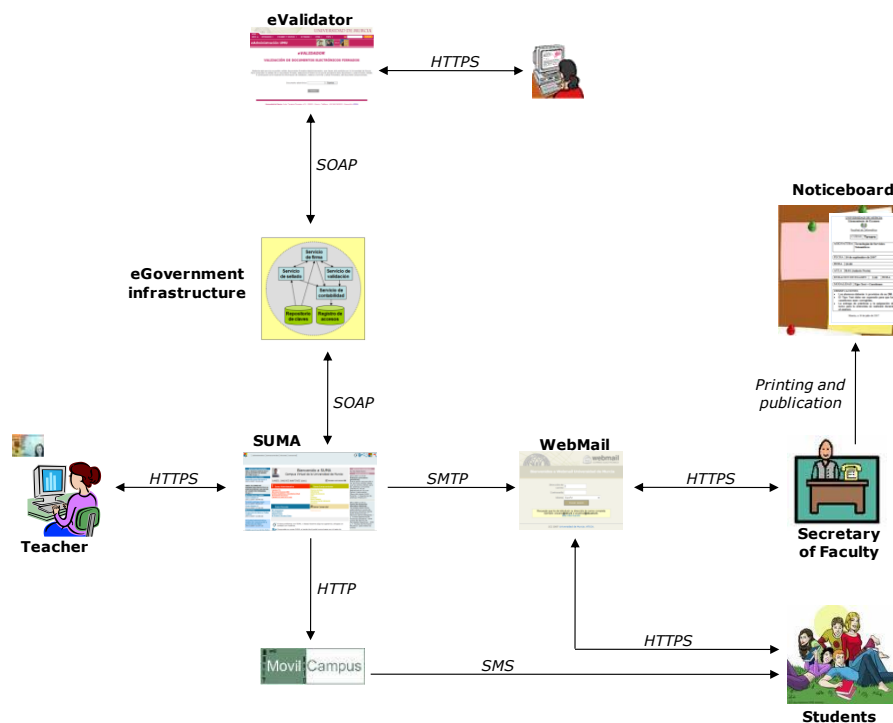

Figure 2. Context diagram about the Publishing of Exam Announcements and Marks Service.

As we can see in figure 2, SUMA is able to interoperate with the e-Government SOA infrastructure of the University of Murcia in order to integrate the electronic signature process with the exam announcements or exam marks documents. The generation of these documents sends an automatic notification by different ways. The students subscribed to the MovilCampus service receive a brief summary of the content of the document in a short message. MovilCampus is a notification mobile service offered to the students by the University for last ten years, with the objective of providing a fast communication channel for news and personal information. In addition to this, an authentic copy of the document in PDF format is sent to the students and to the Secretary of the Faculty through the University mail service. Finally, the Secretary prints and publishes the authentic copy on the public notice board of the Faculty. Each copy is identified by a univocal secure verification code (SVC) printed over the document. The authenticity of the information contained in these public copies can be checked by means of introducing the SVC code in the e-Validator application of the University of Murcia.

The main objectives of the *Express Payment Service* are the development of a system to digitalize invoices and other financial documents in printed paper, and the establishment of a work-flow to validate these new electronic documents, based on electronic signature processes. The main

benefits offered by this service are the avoiding of paper in the administrative procedure and the speeding up of the financial payments. Other important extensions to this project are the reception of electronic invoices sent by a provider, the development of an OCR to simplify the integration of paper invoices, and the establishment of agreements with financial entities to exchange electronic documents. This last topic is analyzed in next section.

4.2. External interoperability

Regarding external interoperability, the Electronic Government infrastructure of the University of Murcia is able to interoperate with other existing infrastructures provided by some public entities, like the Ministry of Public Administration (through the SARA network) (MAP, 2008), the Savings Banks Spanish Confederation (through the sending of accounting documents) (CECA, 2008) or the National Agency for Tax Administration (through the Facturae specification) (AEAT, 2008). Next, we comment these public entities and their services.

The Ministry of Public Administration or MAP offers a network, called SARA, which provides some services to other Public Administrations which have intranet access to this network. The services offered by SARA are related to generation and validation of timestamp tokens from different Time Stamping Authorities (TSAs), validation of electronic Spanish Identity Document (DNIE) as well as digital certificates issued by all Spanish Certificate Authorities, and checking that a person is included in a specific population census. The University of Murcia interoperates with this network for the purposes of requesting information to other external entities, that the Ministry of Public Administration has direct access to, thus acting as a bridge between the University and those external entities. In this way, the University of Murcia is agnostic regarding the different agreements reached between the Ministry of Public Administration and the external entities.

The Spanish Confederation of Savings Banks or CECA offers a service that is in charge of sending accounting documents to other entities. These accounting documents must have been created according to a standard format, which includes one or more advance XAdES compliant signatures (ETSI, 2004). XAdES signatures ensure not only the signer certificate integrity but also the sender non-repudiation. These features are guaranteed by signing the signer certificate and by the inclusion of a timestamp calculated over the signature value, respectively. Particularly, the University of Murcia sends payment orders to CECA in order to authorize economic transfer payments, from the University's banks account to other providers' bank account.

The National Agency for Tax Administration or AEAT, along with the Ministry of Industry, has defined a standard format of representing electronic invoices called Facturae (Facturae, 2008). The University of Murcia has adopted this specification in order to make the reception of supplier invoices easy. In this sense, the University is able to receive invoices, which have been created according to Facturae, from different suppliers. Another standard supported by the University of Murcia is UBL-Invoice (UBL Invoice, 2006).

Making use of both internal and external interoperability features supported by the Electronic Government infrastructure, the University of Murcia, after receiving services form a specific supplier, is able to carry out the following process: firstly, the University receives a electronic invoice, according to Facturae or UBC-Invoice specifications, from the supplier; then, this invoice is validated by the University internal processes (Express Payment Service) and finally, if the validation successes, the University orders a bank transfer from its account to the provider's one, by sending a payment order through CECA.

5. CONCLUSSIONS

This paper presents the main technical initiatives about electronic document management that has been developed by the University of Murcia for the last year. These steps represent the beginning of a complete transformation of paper-based into electronic ones. The most important issues in this process are the improvement of the technical interoperability inside our University and in the relationships with other public e-governments and organizations, as well as the long-term preservation of electronic documents and signatures.

Moreover, the University of Murcia has to face some important challenges yet. Among these challenges, we find the fulfillment of personal data protection laws and the improvement regarding

the accessibility to e-government applications, offering the same opportunities to all members of the university community. Searching for proper solutions that resolve these problems is essential for the development of a global electronic government scenario.

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