



## Interoperability between platforms without a defined referential model: A semi-automatic learning system for structural pairing



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### ABSTRACT

This paper deals with the exchange of information between universities problematic, but could influence other sectors like banking, health, etc. where there are not standards defined for information exchange. We propose a semi-automatic learning and assessment system that is capable of unifying the way in which each of the universities work by employing a three-step system that will be based on the exploitation of the information offered by the web services in their WSDL files and the way in which each of the universities that had been previously evaluated work. This three-step system would be focused on: (a) taking advantage of the information that is obtained on a structural level from the WSDL, which, using the String-Metrics (Cohen, Ravikumar, & Fienberg, 2003) application, will be able to connect the structures between universities, (b) reinforcing any prior knowledge with a classification system for cases that could not be matched, and (c) applying a reasoning system or rules to support the previous two steps. The main result obtained is a system that is able to interoperate two or more platforms between themselves to automatically share information in spite of their structural difference.

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### 1. Introduction

We must bear in mind that, throughout the past decade, the World Wide Web (WWW) has evolved from a static and monolithic Web, with hypertext and hyperlink applications—or, in other words, static HTML—towards the Web 2.0 (known for its social networks and degree of participation), a Semantic Web. Moreover, we have been hearing people talking about an Internet of Services and Things, where everything is or will be connected with and between everything. A similar tendency is the symbology of the electronic government or administration, which was barely known a decade ago as a concept, an identified activity and a research matter (Heeks & Bailura, 2007), is explicitly known as what “would have seemed as a utopia if dreamed barely a decade ago” (Garson, 2004). The lack of interoperability appears, in this context, as the most enduring and hard issue that our enterprises and government institutions have to face today; due to the development of proprietary software or extensions of the current information systems,

the lack or excess of standards, and the heterogeneity of the software and hardware platforms (The Yankee Group Report, 2003).

Recognizing the benefits of improving the efficiency of providing government services, through electronic means, the initiatives of Electronic Administration have quickly spread during the past few years (Weerakkody, Choudrie, & Currie, 2004).

In the field of e-government, the i2010<sup>1</sup> initiative, the strategic action plan of the European Committee (CEC, 2006a), presents interoperability as a pre-requirement so that “devices and platforms can talk to each other” and so that “services become portable between different platforms”, and identifies it as one of the main building blocks for the common European space for eServices information (CEC, 2006b).

In fact, the establishment of a Pan European system with cross-border interoperability is a key element and a necessary condition for every electronic government initiative of the EU, such as the European Framework of Interoperability (EIF, 2010), the Service Directive 2006/123/CE<sup>2</sup> (European Commission, 2007) and the

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<sup>1</sup> [http://europa.eu/legislation\\_summaries/information\\_society/strategies/c11328\\_en.htm](http://europa.eu/legislation_summaries/information_society/strategies/c11328_en.htm) retrieved August 15, 2014.

<sup>2</sup> [http://europa.eu/legislation\\_summaries/employment\\_and\\_social\\_policy/job\\_creation\\_measures/l33237\\_en.htm](http://europa.eu/legislation_summaries/employment_and_social_policy/job_creation_measures/l33237_en.htm) retrieved August 15, 2014.

Directive 2013/37/UE<sup>3</sup> of the European Parliament and of the Council of June 26, 2013, which modified the Directive 2003/98/CE<sup>4</sup> related to the reuse of information in the public sector.

The Ministers of the European Union (EU) in charge of the policies of Electronic Administration in 2009, and other allies of the EU, adopted unanimously the Declaration of Malmö,<sup>5</sup> which aims at taking advantage of the potential of ICTs as catalysts of a greater degree of transparency and participation of citizens in their relations with the public administrations. Its main contribution is the strategic boost it provides to the so-called third-generation services, directed at satisfying the needs of the citizenship, who assumes a central role in its definition and design. Its objectives include the promotion of the reuse of public data; the multi-channel attention; the implication of the citizens in the process of establishment of public policies; the simplification of procedures and the reduction of administrative loads.

In turn, the Declaration of Granada of April 2010<sup>6</sup> constitutes the first reference draft for the establishment of the European Digital Agenda,<sup>7</sup> incorporating the principles related to the electronic administration to the Declaration of Malmö. Therefore, this agenda is also one of the most iconic initiatives of the Europe 2020 strategy, whose aim is to develop an ambitious plan that seeks to articulate the European economy also in the Web and in a common digital market.

On a national level, Law 11/2007 LAECSP “Law for Electronic Access of Citizens to Public Services”<sup>8</sup> was a law that made it compulsory for Public Administrations to offer their services to citizens via online means. For obvious reasons, such as the economic recession and crisis that we are going through, the implementation of this Law, which was compulsory since January 1, 2010, was relaxed and the administrations began to adapt to it progressively as they were able to.

Electronic procedures and interoperability demanded the need to change the administrative procedures (Steward & Walsh, 2007) (Law 30/1992, of Legal Regime of Public Administrations and Common Administrative Procedure)<sup>9</sup> to which we were used to, of which most were conducted on paper and in person with a civil servant, which in turn often required long waiting queues for certain services, and sometimes even redundant information that the administration already had, such as a photocopy of the national ID; and current payments of our expenses. This led to changes in 2013, when a reformation of the education system took place (Law 7/2013),<sup>10</sup> whose modification involved the creation and simplification of procedures, which in turn made the citizens avoid having to present information that, in some way or another, was already in the hands of the administration or public bodies themselves. Here is where the new concept of Administrative Interoperability was born, since it demands that different administrations are in contact with each other to exchange information so that the citizens do not have to present redundant information, and that they are requested permission to use this information by the corresponding administration

in a case per case basis. Previously, it also required the creation and approval of the National Security Scheme (NSE) and the National Interoperability Scheme (NIS)—Royal Decree 3<sup>11</sup> and Royal Decree 4<sup>12</sup> in 2010—which establish the technical regulations of security and interoperability of information. The National Schemes are very advanced and demanding regulations whose goal is to create objective conditions of interoperability and security that facilitate the exercise of rights and the compliance of duties through electronic means.

The NIS is defined in Section 1 of article 42 of Law 11/2007 as “...the set of criteria and recommendations in terms of security, conservation and normalization of the information, the format and the applications that must be taken into account by the Public Administrations to make technological decisions that guarantee interoperability.”

Moreover, the Technical Regulations of Interoperability<sup>13</sup> developed concrete aspects of different matters that are required to ensure the most practical and operative aspects of the interoperability between the Public Administrations and the citizens. The set of regulations includes the standards of electronic documents and record; digitalization of documents; policies of electronic signature and certificates of the Administration, and even the way that information exchange files should be handled, which are not more than the standard definition of the XML file structure. All of this is not enough for the exchange of information between bodies—such as, for example, the Universities that want to exchange the academic record of a student who is changing from one University to another: currently, this procedure must be made with the academic record printed on paper. If we want the procedure to be conducted electronically, then we would require the creation of common information structures, such as the standard proposed for the e-EDS<sup>14</sup> (Electronic European Diploma Supplement)<sup>15</sup> and through a layer of services, information may be exchanged so that Universities retain the same system of information, but being able to interact with a service layer to exchange the academic record. This service layer must have a certain intelligence or semantics to interpret the data model of an academic record or, even, to interpret the information of the record. The aforementioned proposal is currently being developed in the Platform for Electronic Administration through the SUE<sup>16</sup> interoperability node project, which aims at interoperate the different universities between themselves and with other administrative services, like the Income, Revenue and Public Administrations Service (MINHAP).

## 2. Background and related work

Software has been evolving in many dimensions: the programming tools and languages that are used to create software; the ways in which we approach the process of creation; the models that describe the elements of software and the way they relate and interact with the real (or virtual) world; their complexity and frontiers, from small programs of a few hundred lines of code that are executed in a computer to gigantic distributed systems to

<sup>3</sup> [https://www.boe.es/diario\\_boe/txt.php?id=DOUE-L-2013-81251](https://www.boe.es/diario_boe/txt.php?id=DOUE-L-2013-81251) retrieved August 15, 2014.

<sup>4</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:ES:PDF> retrieved August 15, 2014.

<sup>5</sup> <http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/ministerial-declaration-on-egovernment-malmo.pdf> retrieved August 15, 2014.

<sup>6</sup> <http://www.minetur.gob.es/es-es/gabineteprensa/notasprensa/documentos/declaraci%C3%B3ncastellano.pdf> retrieved August 15, 2014.

<sup>7</sup> <http://ec.europa.eu/digital-agenda/> retrieved August 15, 2014.

<sup>8</sup> [http://www.boe.es/diario\\_boe/txt.php?id=BOE-A-2007-12352](http://www.boe.es/diario_boe/txt.php?id=BOE-A-2007-12352) retrieved August 15, 2014.

<sup>9</sup> [http://noticias.juridicas.com/base\\_datos/Admin/l30-1992.t6.html](http://noticias.juridicas.com/base_datos/Admin/l30-1992.t6.html) retrieved August 15, 2014.

<sup>10</sup> [http://noticias.juridicas.com/base\\_datos/CCAA/517405-l-7-2013-de-21-nov-castilla-la-mancha-adequacion-de-procedimientos-administrativos.html](http://noticias.juridicas.com/base_datos/CCAA/517405-l-7-2013-de-21-nov-castilla-la-mancha-adequacion-de-procedimientos-administrativos.html) retrieved August 15, 2014.

<sup>11</sup> <http://www.boe.es/buscar/doc.php?id=BOE-A-2010-1330> retrieved August 15, 2014.

<sup>12</sup> <http://www.boe.es/buscar/doc.php?id=BOE-A-2010-1331> retrieved August 15, 2014.

<sup>13</sup> [http://administracionelectronica.gob.es/pae\\_Home/pae\\_Estrategias/pae\\_Interoperabilidad\\_Inicio/pae\\_Normas\\_tecnicas\\_de\\_interoperabilidad.html#U-3AsmACTIU](http://administracionelectronica.gob.es/pae_Home/pae_Estrategias/pae_Interoperabilidad_Inicio/pae_Normas_tecnicas_de_interoperabilidad.html#U-3AsmACTIU) retrieved August 15, 2014.

<sup>14</sup> <http://ecctis.co.uk/europass/documents/Europe%20Unit%20Diploma%20Supplement%20Guide.pdf> retrieved August 15, 2014.

<sup>15</sup> [http://ec.europa.eu/education/tools/diploma-supplement\\_en.htm](http://ec.europa.eu/education/tools/diploma-supplement_en.htm) retrieved August 15, 2014.

<sup>16</sup> <https://www.rediris.es/jt/jt2013/ponencias/jt2013-jt-sesion1b-a10b4c1.pdf> retrieved August 15, 2014.

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