1. General information

1.1. Title of the case study
(What is the title of the initiative described by this case study?)

Description	**Electronic Diploma Supplement (e-DS)**

1.2. Policy domain(s)[1]
(What are the horizontal policy domains or domain-specific policies which are covered by this case study?)

Description	The **Diploma Supplement (DS)** is a document accompanying a higher education diploma, providing a standardized description of the nature, level, context, content and status of the studies completed by its holder. It is produced by the higher education institutions. The DS is designed as an aid to help recognition, in order to facilitate academic and professional mobility. It is used as an official certification, and it is issued in a standardized paper format. The **e-DS** is a proposed content model for the **DS** from an XML specification.

1.3. Contact details
(Please provide the contact details of a person who could provide further details about this case study)

Description	Daniel Sánchez Martínez (danielsm@um.es) e-Government Project Manager – University of Murcia e-Government Working Group Coordinator – CRUE-TIC Working Group additional contacts: - Manuel Ángel Rodríguez Ruano (manuel.ruano@usc.es) - Carlos Gómez Otero (carlos.gomez@usc.es) - Lluís Alfons Ariño (lluisalfons.arino@urv.cat)

1.4. References
(Please provide references to information resources about this case study)

Description	PAE. Portal de Administración Electrónica. http://administracionelectronica.gob.es/ctt/sete CISE. Gestor de Activos Semánticos. http://cise.redsara.es/SGAS SET-e: un modelo de datos para la interoperabilidad académica http://www.cnis.es/images/informes/CNIS%202014%20-%20SET-e.pdf

2. Business model

2.1. Problem & challenges
(What are the problems which your data standards help to solve and how did you realise those? E.g. system integration, consistency, redundancy, integrity, cost

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[1] http://ec.europa.eu/yourvoice/consultations/links/index_en.htm

	reduction, quality of data, transfer of information between multiple IT systems, etc.)
Description	DS provides information about the level, context and contents of the certified studies from official titles issued by higher education institutions in the European Higher Education Area (EHEA). It also provides transparency and facilitates academic and professional recognition of qualifications.
	This document is issued by higher education institutions according to the rules agreed by the European Commission, Europe Council and UNESCO.
	Although these rules define the required information in the DS and it is mainly issued on paper, there is not a unique electronic format defined for the issuing institutions, and this lack of uniformity does not allow to automatically operate with the information from the DS and hinders the issuance and electronic reuse.
	To cover this lack, the following content model has been developed. Its main goals are:
	- To promote <u>interoperability and automatic interpretation</u> of data contained in the DS between different organizations, both national and international, in order to boost mobility in the EHEA. - To establish a comprehensive and <u>extensible specification</u> responding to national needs in terms of internal legislation, but also serving as a European reference format. - To facilitate the e-DS <u>impression</u> using predefined style sheets providing independence from the print provider and promoting free competence. - To get a fully legal <u>electronic administrative document</u>, enabling both electronic and paper expedition through authenticated copy procedures

2.2. Targeted audience
(Describe your targeted audience in terms of direct and indirect beneficiaries.)

Description	
	- Institutions of Higher Education as generators of the data model. - Employers (companies and public organizations) as data recipients. - Students as data owners. - Service companies related to the new opportunities based on the proposed model.

2.3. Solution
(Describe your data standards: what are the main entities modelled, which formats you use and whether they are accessible via the web to third parties)

Description	The XML data model of e-DS has been designed following the information contained in the document "Outline Structure for the Diploma Supplement"[2] and the labels from "ECTS Label"[3] and "Diploma Supplement Label"[4]. The elements of the schema were named in English in order to promote international interoperability. The glossary of terms are the ones which are used in previous documents. The minimum information needed for the DS issuance is defined, and elements and optional attributes providing added value in specific contexts are included. As main features highlights the usage of rich text to provide an attractive impression using customized style sheets, the addition of attached documents referenced from optional elements, the introduction of external web links with extra information and, finally, the integration of electronic signature elements. In addition, the inclusion of all information related with an academic subject or module is allowed: Code, Title, Level, contents, etc. All those concepts are compiled in a European level at the "ECTS Users' Guide"[5] The information contained in the e-DS is organized in eight mandatory sections and three optional ones. • **Information Identifying The Holder Of The Qualification**: information of the university qualification holder • **Information Identifying The Qualification**: information of the qualification, title and institutions involved in the studies. • **Information Identifying The Holder Of The Qualification**: information related to the level, duration, and access requirements to the qualification. • **Information On The Contents And Results Gained**: information about contents and obtained marks, including the detailed schedule of the studies. • **Information On The Function Of The Qualification**: information about the studies access and professional qualification. • **Additional Information**. • **Certification Of The Supplement**: data related to the delivery date, signatures, positions and stamp of the institution issuing the DS. • **Information On The Higher National Education System**:

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[2] http://ec.europa.eu/education/policy/higher-education/doc/ds_en.pdf

[3] http://eacea.ec.europa.eu/llp/support_measures_and_network/ects_dsl_en.php

[4] http://eacea.ec.europa.eu/llp/support_measures_and_network/ects_dsl_en.php

[5] http://ec.europa.eu/education/tools/docs/ects-guide_en.pdf

	information of the national high education system
	• **Attachments** (optional): list of files attached to the DS.
	• **Extension Content** (optional): the possibility of including sectorial extensions in the DS is offered. This covers the need of representing specific information in a concrete environment.
	• **Signature** (optional): addition of multiple electronic signatures according to the "XML Signature" standard[6].
	The proposed model allows the expedition of DS in different languages. In Spain it must be issued at least in Spanish and English, and in the case of some autonomous regions the addition of the co-official language as third language is allowed.
	The models of the XML schema, its documentation and related examples are available for download at PAE[7] and CISE[8]

| Description | The implantation of this data model in the university context promotes the development of different applications and additional services, as the e-DS issuance and verification through university website, the provision of academic attributes to other entities and the ubiquitous access to academic information from mobile devices.

It is also important to remark that this data model can facilitate the recognition of studies and degrees between universities, making quite easy to evolve towards other data models necessary to represent tuitions, academic records or academic certificates.

The DS is free for the student, but not for the issuing institution. This data model makes the DS issuance in paper and electronic format cheaper.

So, the e-DS offers to <u>universities</u> a mechanism for exchanging academic information through electronic means. It offers to <u>companies</u> data focused on the employability, and finally the |
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[6] http://www.w3.org/TR/xmldsig-core/

[7] http://administracionelectronica.gob.es/ctt/sete

[8] http://cise.redsara.es/SGAS

	graduated student gets an official electronic document fully legal and recognized[9].
2.5. Cost structure *(What are the cost elements to deliver your value proposition? Please consider both fixed and recurring costs. Were your initial cost estimations accurate?)*	
Description	The cost to develop the e-DS is evaluated at 50 person-days, plus the number of person-days invested by the members of the Working Group who provided their input during the development lifecycle, for which there are no records. To accommodate change requests, during the revision of the e-DS there were necessary 10 person-days. The cost for publication is estimated to be 2 person-days.
2.6. Revenue streams *(How does the owner of the data standards fund the design and operational costs, e.g. sources of revenue and pricing model?)*	
Description	Public funding.
2.7. Key metrics *(What are the key metrics (or indicators) to assess the success of your data standards solution? Describe how you measure the success of your solution from the point of view of those who implement data standards).*	
Description	Between January 1st 2014 and November 31st 2015, the webpage hosting the e-DS counted 9,115 unique visits, and 400 downloads. e-DS has been adopted as academic data model in the development of the STORK2 project[10]. The aim of this project is the pan-European recognition of electronic identities and attributes through the implementation of different pilot projects during 2015. STORK2 involves two Spanish universities, Universitat Jaume I[11] and Universidad de Murcia[12], coordinated by the Spanish Ministry of Finance and Public Administration (MINHAP). Furthermore, the Royal Decree 22/2015, January 23rd, which regulates the issuance of DS in Spain[13], and its subsequent development in the grade and master study guides published on September 14th 2015 by the General Director of University Policy

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[9] http://ec.europa.eu/education/tools/diploma-supplement_es.htm

[10] https://www.eid-stork2.eu/

[11] https://ujiapps.uji.es/

[12] http://www.um.es/

[13] http://www.boe.es/diario_boe/txt.php?id=BOE-A-2015-1158

		(previous report of the Spanish Council of Universities), compiles the mandatory use of e-DS for generating and electronic issuance[14]. In addition, some universities have started to generate this format in the frame of the different interoperability projects promoted by the <u>Conference of Spanish University Chancellors (CRUE)</u>[15], which represents more than 70 universities.
2.8. Key activities *(Describe the necessary activities to generate the value proposition described above)*		
	2.8.1. Governance *(Provide information related to the governance, such as governance structure, enforcement policy, quality controls)*	
	Description	CRUE is a non-profit association formed by Spanish public and private universities. Currently there are associated 50 public and 25 private universities. The MINHAP joined CRUE to the Working Group of Sectoral Committee on e-Government in November 2010, assuming the responsibility of defining the aspects related with the higher education sector. The <u>Sectorial Committee of Information Technologies and Communication of the CRUE</u> (CRUE-TIC)[16] was born in late 2003 from the awareness and concerns that CRUE had on the role that those technologies were already playing in universities. The objectives of CRUE-TIC are, on one hand, to advise and propose to the CRUE appropriate topics and issues in the field of information technology and communications, in order to improve the quality, effectiveness and efficiency of the Spanish universities; on the other hand, to study together the needs and applications of those technologies in the management, university teaching and research, also proposing actions and joint projects. Within CRUE-TIC there is a specific <u>Working Group on e-Government</u>, with different ongoing work plans about interoperability, security and re-use of platforms. It is also the responsibility of this group to define the data models of the higher education sector, the design of interoperability model of the Spanish University System (SUE) and the commitment with technological solutions that promote interoperability in the scope of Law 11/2007 and the National Interoperability Schema (ENI).

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[14] http://www.mecd.gob.es/educacion-mecd/dms/mecd/educacion-mecd/areas-educacion/universidades/educacion-superior-universitaria/titulos/suplemento-europeo/guia-expedicion-set-grado.pdf (page 16)

[15] http://www.crue.org/

[16] http://www.crue.org/TIC/Paginas/default.aspx

		e-DS is the first of the data models defined by CRUE-TIC, and it will be followed by models like the university tuition and the student academic records data model.
	2.8.2. Management *(Describe how you cover the following management activities: design, change management including maintenance activities, harmonisation, publication, deployment and retirement.)*	
	Descript ion	The design, development and updates management of e-DS model is performed by the CRUE-TIC Working Group on e-Government. Suggestions and demands are received through the PAE or internal own mail lists of the CRUE, depending on the needs of universities and other organizations. Once a version is finished it is upgraded to the executive board of CRUE-TIC for review and introduction to other sectors of the CRUE and specific groups, such as the Sectorial Committee of Secretaries General (COSEG)[17] and the Conference of Universities Archivists (CAU)[18]. Once it is validated by all of them, in coordination with MINHAP the new version is published in the PAE and in the CISE.
	2.8.3. Tools *(Describe the tools that you use to support the aforementioned management processes)*	
	Descript ion	**PAE**. Portal de Administración Electrónica. http://administracionelectronica.gob.es/ PAE is the information entry point about status, development, analysis, trends and actions around e-Government, integrating contents and services from different sources. Also has become an opinion aggregator, engine of participation and invigorates the community with interest in different areas. **CISE**. Centro de Interoperabilidad Semántica. http://cise.redsara.es/ The CISE is the tool defined in the "National Schema of Interoperability" to publish the exchange data models and associated codifications from different administrations, using the "Semantic Actives Manager".
	2.8.4. Standards *(What are the industry standards which your development process complies with or directly reuses? E.g. standards endorsed by organisations such as ISO, CEN, W3C, OASIS, UN-CEFACT, OpenGroup, OGC etc.)*	

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[17] http://www.crue.org/queEsCrue/Paginas/COSEG.aspx

[18] http://cau.crue.org/

	Descript ion	• ISO 639. For the codification of the languages used in the e-Ds. • ISO 3166-1-alpha-2. For the codification of the countries. • ISCED. International Standard Classification Of Education • EHEA Framework: Bologna. Framework of Qualifications/European Qualifications Framework • XML Signature. e-DS electronic signature.

2.9. Strengths

(What are the proven strengths of your data standards? Please base your description on facts as much as possible, to provide an objective overview)

Description	• Establishment of minimum basic fields and provision of multiple optional fields adding value in specific contexts. • Definition of rich text elements to promote attractive prints through custom stylesheets. • Definition of optional extension elements useful in sectoral environments, national contexts, etc. • Integration of electronic signature elements suitable with national and European electronic signature standards and developments. • Possibility of including attached files referenced from optional elements. • Policy of naming the elements in English in order to facilitate their internationalization.

2.10. Weaknesses

(What are the weak points of your data standards, or limitations? Please base your description on facts as much as possible, to provide an objective overview)

Description	• This data model is still not widespread and has a low number of implementations. • Some of the elements defined in the model are optional in order to enable compatibility in different countries, but in some contexts it would be recommended to be mandatory.

3. Implementation experience

3.1. Known implementations

Please list at least one practical implementation of your data standards (and specify if it is about country specific or cross-border implementations, pilot projects, or real life implementations), and any indication of their potential success. If you want to describe more implementations, please copy the section 3.1.1. below, paste it before section 3.2., and renumber it to 3.1.2.

	3.1.1. Implementation	
		3.1.1.1. Description *(Please include in your description also information about the implementer, such as: who is the implementer? When was the implementation done? What was the main reason to implement your data standards?)*

		Description	**STORK 2.0**. Cross-border pilot.
			Secure idenTity acrOss boRders linKed (STORK) is a project co-funded by the European Commission as a part of its Competitiveness and Innovation Programme (CIP) in order to address, in a cross-border scenario, the identity management problem. Composed 29 partners and 14 countries, this project finished on December 2011. As a result, a hard and trustable authentication scheme that relies on a first-class distributed infrastructure has been built and tested. In this first step the authentication and authorization problem in a cross-border federated environment was solved.
			Added value to the infrastructure deployed can be envisaged: the need for exchange of complex attributes, more electronic services to widespread the use of electronic credentials and attribute interchange versatility are still problems to be solved. To develop and test those added-value services is the main focus of STORK 2.0[19].
			One of the STORK 2.0 pilots implemented is the <u>Academic Qualifications pilot</u>, which brings together 18 partners from 11 different countries. This pilot involves the private sector in the use of academic information, such the e-DS, by providing the means to use it for their own purposes (such as job qualification / selection) and to enable proof of required qualifications and specifications to be carried out online.
			This was done in Q2 2015.
		3.1.1.2. Contact details *(Please provide contact details of a person who can provide further details about this implementation of you data standards)*	
		Description	Vicente Andreu Navarro (<u>andreuv@uji.es</u>). Universitat Jaume I. Antonio F. Gómez Skarmeta (<u>skarmeta@um.es</u>). University of Murcia.
		3.1.1.3. References	

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[19] https://www.eid-stork2.eu/

		(Please provide references to information resources about the implementation of your data standards)
		Description	Deliverable - D4.9 Final version of Functional Design. 2.4.1. Definition for Academic Data. https://www.eid-stork2.eu/index.php?option=com_phocadownload&view=file&id=66:d49-final-version-of-functional-design&Itemid=174 Deliverable – D5.1.4 eAcademia Pilot Progress Report https://www.eid-stork2.eu/index.php?option=com_phocadownload&view=file&id=57:d514-eacademia-pilot-progress-report&Itemid=176

		3.1.1.4. Success of implementation
		(How successful is the implementation of your data standards? If possible, provide any measured benefits that can demonstrate the success.)

| | | Description | Pilot <u>Academic Attribute Verification for Job Qualification / Selection</u>

This use case allows the interchange of the e-DS between universities and private companies with the consent of the user that owns the data. The services designed provide proof of required qualifications for selection for a job or for general purposes.

This pilot reduces the burden of administrative tasks derived from the mobility of students among academic institutions from different countries.

It also allows academic data to be made accessible to both private and public institutions while ensuring that citizens' rights are safeguarded.

https://www.eid-stork2.eu/pilots/elearning/index.php/en/ |
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		3.1.1.5. Extensions
		(Was there any extension of your data standards necessary for this implementation?)

		Description	Within the STORK 2.0 project, the model was extended in order to make its use easy in

			non-university diplomas, as well as for representing current unfinished studies.
		3.1.1.6. Implementation support *(Was there any support requested from the development team who implemented your data standards?)*	
		Description	Resolution of doubts about some elements during the first weeks of implementation.
		3.1.1.7. Implementation challenges *(What were the challenges encountered during the implementation of your data standards?)*	
		Description	Having available all the necessary data within information systems in order to generate the electronic format, especially in old degrees that already are extinct.
	3.1.2. Implementation		
		3.1.2.1. Description *(Please include in your description also information about the implementer, such as: who is the implementer? When was the implementation done? What was the main reason to implement your data standards?)*	
		Description	**DS issuance in paper** Currently, Didoseg Documentos SA company, which is specialized in customizing and printing of diplomas and other documents, has adapted its <u>Didoseg Cloud platform</u> in order to enable the DS issuance in paper format from e-DS format. Therefore, a university is able to send, in an electronic way, the e-DS to Didoseg cloud services to be <u>printed in security paper</u> and be downloaded in PDF format.
		3.1.2.2. Contact details *(Please provide contact details of a person who can provide further details about this implementation of you data standards)*	
		Description	Carlos Santurino (<u>carlos.santurino@didoseg.com</u>) Didoseg Documentos de Seguridad <u>http://www.didoseg.com/</u>
		3.1.2.3. References *(Please provide references to information resources about the implementation of your data standards)*	

		Description	Didoseg http://www.didoseg.com/fabricacion-impresion-y-personalizacion-de-diplomas/
		3.1.2.4. Success of implementation *(How successful is the implementation of your data standards? If possible, provide any measured benefits that can demonstrate the success.)*	
		Description	Inclusion of e-DS in Didoseg Cloud platform. http://www.didosegcloud.com/
		3.1.2.5. Extensions *(Was there any extension of your data standards necessary for this implementation?)*	
		Description	The e-DS model provides a mechanism to increase country-specific contents, without affecting interoperability with other countries. This implementation makes use of the Spanish extension of the model. Its namespace is as follows: xmlns:aclansp="urn:crue:academic:xsd:language:diplomasupplement:spain"
		3.1.2.6. Implementation support *(Was there any support requested from the development team who implemented your data standards?)*	
		Description	Resolution of doubts about some elements during the first weeks of implementation.
		3.1.2.7. Implementation challenges *(What were the challenges encountered during the implementation of your data standards?)*	
		Description	The main challenge has been the application of Royal Decree 22/2015, as well as the guidelines included in the guides of both degree and master`s degree for the DS issuance in both paper and electronic format.
	3.1.3. Implementation		
		3.1.3.1. Description *(Please include in your description also information about the implementer, such as: who is the implementer? When was the implementation done? What was the main reason to implement your data standards?)*	
		Description	**e-DS generation in Universities.** Different universities, due to the impulse of several CRUE projects, have started to adapt

			their information systems in order to generate e-DS.
			For example, currently, the <u>University of Santiago de Compostela (USC)</u> issues DS both in paper and electronic format. Documents issued jointly are available to the student once the diploma is requested and the fees are paid.
			It is expected that during 2016 the model will be gradually implemented in the rest of universities.
		3.1.3.2. Contact details *(Please provide contact details of a person who can provide further details about this implementation of you data standards)*	
		Description	Ramón García Rey (r.garcia.rey@usc.es) Academic Management Services University of Santiago de Compostela
		3.1.3.3. References *(Please provide references to information resources about the implementation of your data standards)*	
		Description	DS in USC https://www.usc.es/es/perfis/egresados/set.html
		3.1.3.4. Success of implementation *(How successful is the implementation of your data standards? If possible, provide any measured benefits that can demonstrate the success.)*	
		Description	The main benefit obtained is the provision of the e-DS to students from the webpage of the University in a short period of time. The USC has already issued, during last quarter of 2015, over two hundred degree and master's degree diploma supplements according to the Spanish Real Decree 22/2015.
		3.1.3.5. Extensions *(Was there any extension of your data standards necessary for this implementation?)*	
		Description	The e-DS model provides a mechanism to increase country-specific contents, without affecting interoperability with other countries.

			This implementation makes use of the Spanish extension of the model. Its namespace is as follows: xmlns:aclansp="urn:crue:academic:xsd:language:diplomasupplement:spain
		3.1.3.6. Implementation support *(Was there any support requested from the development team who implemented your data standards?)*	
		Description	Resolution of doubts about some elements during the first weeks of implementation in each university.
		3.1.3.7. Implementation challenges *(What were the challenges encountered during the implementation of your data standards?)*	
		Description	The main challenges have been associated with the adaptation, structuring and the inclusion of the information contained in the Royal Decree, as well as the development of the supporting guidelines for the academic management application of each University.