InterPARES Trust Project
Research Report

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Contents

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INTRODUCTION

IntePARES Trust project approved an analysis of the interoperability possibilities of implemented governmental e-services in the EU focusing on aspects which might be important for their implementation as trusted e-services. This project (Phase II) was the continuation of the previous research "Comparative Analysis of Implemented Governmental e-Services (EU09)" (Phase I).

Based on the results of the previous research "Comparative Analysis of Implemented Governmental e-Services" which detected the absence of publically available information important for establishing trust in e-Services, particularly the information considering "Storage and long-term content availability" and "System operation transparency", the intention was to investigate the differences in the level of development of e-Services. Building on the results of the previous research, this project analyzed the implemented governmental e-Services in the EU in the context of national single sign-on systems (SSO) in order to detect possibilities of exchanging identification and authentication credentials among them thus creating a network of trust between the national systems enabling citizens to seamlessly use other country's e-Services.

Research timeline: 15 October 2014 to 15 July 2015.

This research involved 6 graduate research assistants.

Project ideas and achieved results were disseminated:

1. Stančić, Hrvoje, **Report on the InterPARES Trust Project**, in: Babić, Silvija (Ed.), Dostupnost arhivskoga gradiva, Hrvatsko arhivističko društvo, Vinkovci, 2014, pp. 521-527 (published paper presented at the 47th Symposium of Croatian Archival Society, **Availability of archival material**, 22-24 October 2014, Vinkovci, Croatia)

2. InterPARES Trust **visibility event** - **Presentation of InterPARES Trust research results**, organised by project partner Faculty of Humanities and Social Sciences, University of Zagreb, Croatia, 21 November 2014

3. Stančić, Hrvoje, **Project InterPARES Trust – project activities**, 18th seminar Archives, Libraries, Museums – possibilities of cooperation in environment of global information infrastructure, 26-28 November 2014, Rovinj, Croatia
4. Stancic, Hrvoje. **Achieving Interoperability of Governmental e-Services between EU Countries**, Research Symposium: Open data and information governance: recordkeeping roles?, UCL, London, 20 May 2015
5. Garic, Ana; Lovasic, Ana; Stancic, Hrvoje. **Analysis of the Interoperability Possibilities of Implemented Governmental e-Services – progress report**, InterPARES Trust – Joint European & Transnational Teams Research Workshop, London 21-22 May, 2015
6. Stancic, Hrvoje. **Analysis of the Interoperability Possibilities of Implemented Governmental e-Services – discussion on the preliminary findings with the Deputy Minister of Public Administration for e-Croatia**, Ministry of the Public Administration, 21 July 2015

RESEARCH

Research methodology

The research was divided in four stages: (1) Identification, (2) Data acquisition, (3) Analysis, and (4) Interpretation. The research was limited to the EU region.

1. Identification

Firstly, a literature review was done in order to identify which relevant studies were done so far. At the EU level a number of relevant documents, studies and projects were found which helped direct further research. Then, the environmental scan was done, i.e. single sign-on systems (SSO) and their key components were identified in the EU by country. The research focused on 28 European countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

A single sign-on (SSO) questionnaire was created. The researchers used it while trying to find the information online. The questionnaire was not distributed to third parties in order to find the needed information because the researchers wanted to investigate how much information is available online for the regular users, i.e. citizens. It consisted of 29 questions divided into 6 categories as follows:

1. Users (3 questions)
2. Legal Framework and Strategies (2 questions)
3. Portals (1 question)
4. Single Sign-on (SSO) (15 questions)
5. Trust mechanisms – technical details (7 questions)
6. Future plans (1 question)

The questions were:

1. Users	
1.	Population
2.	Percentage of households with a broadband connection (potential users)
3.	Percentage of individuals using the internet for interacting with public authorities (real users)
2. Legal Framework and Strategies	
4.	Is there a national IT strategy concerning e-Government?
5.	What are the main (2-3 most important) e-Government legal texts concerning e-Identification / e-Authentication
3. Portals	
6.	Central e-Government portal (URL)
4. Single Sign-on (SSO)	
7.	Is there a SSO system in place?

8.	SSO name (English + original)
9.	Implementation date
10.	How are users authenticated?
11.	Is there a physical aspect involved in e-Identification (token, smart card, SIM card...)?
12.	Who issues certificates / usn/psw?
13.	What is the identity data governing body? (Where does the personal information come from? Central Directory/Register?)
14.	What is the source of users' identity authentication (SSN (OIB), driver's license, eID, passport,…?) – one or more documents needed?
15.	Is there one or more levels of access depending on different user's credentials (e.g. AAI vs. FINA)?
16.	Number of users (if available)
17.	Terms of Use – domestic vs. foreigners
18.	How many services are connected via SSO?
19.	Which services are connected via SSO (Service name)?
20.	Is there a possibility of log-on to a connected service without using SSO, i.e. by accessing their web-site directly and using their log-on service (different credentials from SSO credentials)?
21.	Is it possible to obtain an e-document from one e-service and send it to another e-service via safe transfer methods – safe document transfer?
5. Trust mechanisms – technical details	
22.	What federated authentication standards are supported and used (SAML 2.0 – *Security Assertion Markup Language* / Shibboleth – *open source software package for web single sign-on*)?
23.	What version of the specification is used?
24.	What encryption levels/standards are used?
25.	Does the system require digital signatures? If yes – which type(s) – standard or advanced, XMLDSig, XAdES etc.?
26.	Is it possible to achieve protocol interoperability (LDAP)?
27.	What technology was used to develop SSO?
28.	Is the SSO a part of STORK initiative?
6. Future plans	
29.	Are there any plans in place for future Identity Federation solutions

Motivation

The set of 29 questions divided into 6 categories was considered as sufficient to provide enough information on key components of single sign-on systems. The research team believes that the developed questionnaire is sufficient to analyze the implemented governmental e-services in the context of national single sign-on systems in order to detect the possibilities of exchanging identification and authentication credentials.

2. Data acquisition

In the second phase the developed questionnaire was used to gather information on the relevant aspects of single sign-on systems in 28 countries. The questionnaire was filled out by the researchers during the online investigation. The total of 812 questions were (tried to be) answered. Of course, some questions were unanswered due to different reasons (mentioned later in detail) like technology-related problems or unavailability of online information.

3. Analysis

This phase followed the data acquisition phase and was, during certain period of time, overlapping with it. Filled out questionnaires on single sign-on systems were firstly analyzed by country and then comparatively across countries (28). The detailed results are given later in this report.

4. Interpretation

In the last phase the results of the analysis were interpreted and the recommendations were formulated. The results of this and previous phase are incorporated in the results given below. They are organized, analyzed and interpreted through the 6 categories of the questionnaire questions aggregating and comparatively presenting the results from all analyzed countries. But, before giving those, rather extensive results, here is the highest level of aggregation and interpretation, or a summary of the overall results by the categories.

1. Users
The percentage of households with a broadband connection (potential users) ranges from 56% to 93%, while the percentage of individuals using the internet for interacting with public authorities (real users) ranges from 10% to 84%. Certain countries have utilized the number of households with a broadband connection thus minimizing the gap between potential and real users (<10%) while other have not used that potential and still need to show greater attention to motivating their citizens to use the Internet to interact with the public authorities.

2. Legal Framework and Strategies
Most of the analyzed countries have certain legal regulations regarding e-Government and 57% of them have a national IT strategy planned to be accomplished by 2020. The research team also found certain legal documents regarding e-Identification/e-Authentication (e.g. data protection acts and legal frameworks for electronic signatures). It is important not only to view the complexity of SSO implementation from the technical point of view, but also to have defined and clear legal regulations and frameworks on national and transnational level in order to provide fully functional, safe and complete interoperability.

3. Portals

All EU countries have a central e-Government portal which can be used as an informative and/or single access point to all e-Government services offered from both state and local authorities. However, 19 out of 28 countries (68%) have developed an SSO system. Countries that have not yet developed SSO also had a greater discrepancy between potential and real users.

4. Single Sign-on (SSO)

Research was focused on 12 G2C Government to Citizens (G2C) e-Services and was investigating their connection via SSO systems. On average, seven e-services are connected via SSO. The top three most implemented e-services are social security benefits, application for building permission, and announcement of moving (change of address) e-service. Virtual methods of authenticating users (e.g. username/password) are more common than usage of physical devices (e.g. smart cards or tokens).

5. Trust mechanisms – technical details

Questions regarding technical details of different trust mechanisms provided little-to-no answers in general. Federated authentication standards identified as implemented in some SSOs were SAML, Liberty Alliance, Shibboleth and XHTML. Encryption levels/standards being used are SSL, TLS, XML Encryption / Signature, and WS-S. Out of the 19 implemented SSOs, 6 of them are part of the STORK initiative.

6. Future plans

Most of the plans for upgrading the SSO systems are concerning process optimization, security improvements or technical upgrades.

Analysis of the interoperability possibilities of implemented governmental e-services

1. Users

Graph 1 shows the ratio between the percentage of potential and real users. The percentage of households with a broadband connection (potential users) ranges from 56% (Bulgaria, Croatia) to 93% (Luxembourg), while the percentage of individuals using the internet for interacting with public authorities (real users) ranges from 10% (Romania) to 84% (Denmark). As seen on Graph 1, certain governments have shown great initiative to motivate their citizens to use the Internet for interacting with public authorities. Countries like Denmark and Finland have utilized the number of households with a broadband connection thus minimizing the gap between potential and real users (<10%). On the other hand, certain countries (e.g. Bulgaria, Czech Republic, Estonia, Germany, Italy, Malta, Poland, Portugal, Romania, the United Kingdom) have not used the full potential of number of households with broadband connection since the difference between potential and real users is rather high (≥30%) and still need to show greater attention to motivating their citizens to use the Internet to interact with the public authorities.
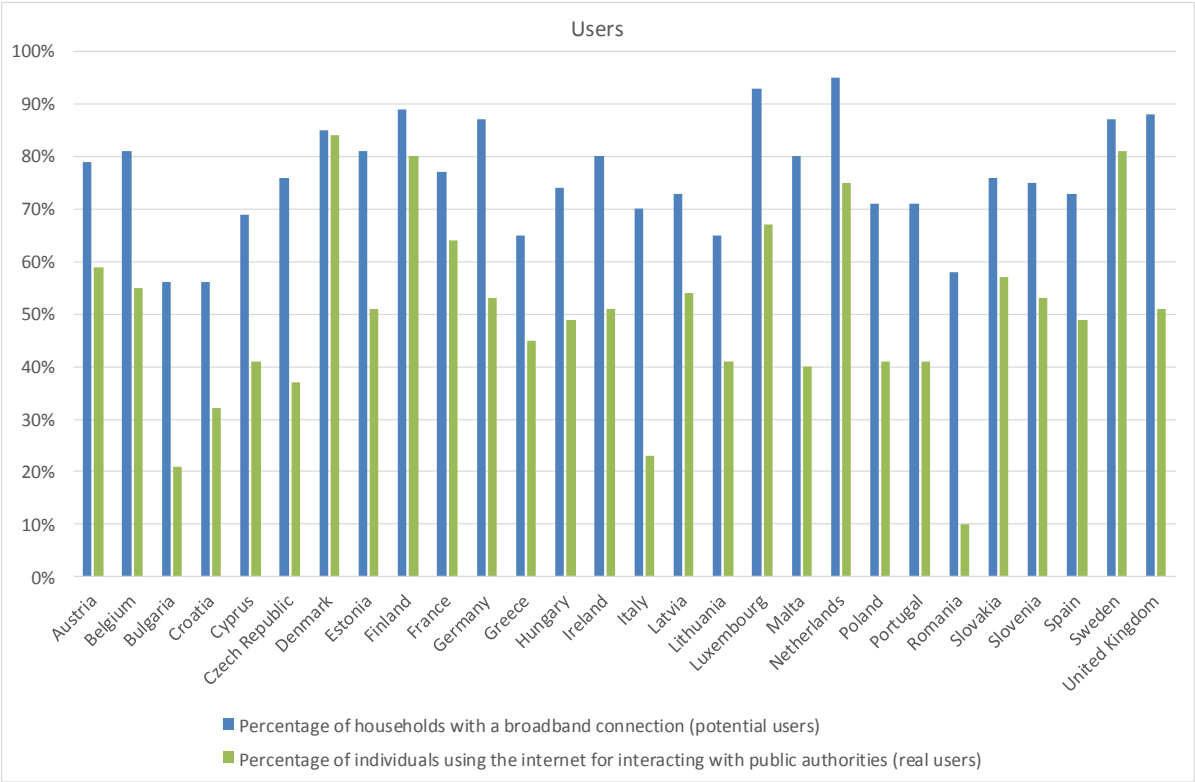

Graph 1. Percentage of potential and real users

2. Legal Framework and Strategies

When exploring legal frameworks and strategies the team was investigating those countries with a national IT strategy concerning e-Government and/or e-Government legal texts concerning e-Identification/e-Authentication. Results of the research show that most of the analyzed countries have certain legal regulations regarding e-Government and 57% of them have a national IT strategy planned to be accomplished by 2020. Although by consulting the European Commission Factsheets it was found that 32% of the analyzed countries currently do not have specific e-Government legislation, the research team was able to detect certain legal documents regarding e-Identification/e-Authentication (e.g. data protection acts, legal frameworks for electronic signatures and associated matters). From this it can be concluded that it is important not only to view the complexity of SSO implementation from the technical point of view, but it is also important to have defined and clear legal regulations and frameworks on national (and transnational level) in order to provide fully functional, safe and complete interoperability.

3. Portals

In all of the analyzed countries there is a central e-Government portal which can be used as an informative and/or single access point to all e-Government services offered from both state and local authorities. On the other hand, 19 of 28 of the analyzed countries (68%) have developed SSO system which makes e-services easily accessible to end users (Graph 2). One can assume that there is certain connection between countries that have not implemented a SSO system (e.g. Bulgaria, Czech Republic, Germany, Romania, the United Kingdom) and that have a greater discrepancy between potential and real users since the implementation of SSO system makes it easier for citizens to access governmental e-services thus motivating them for greater interaction with public authorities via internet.

SSO implementation
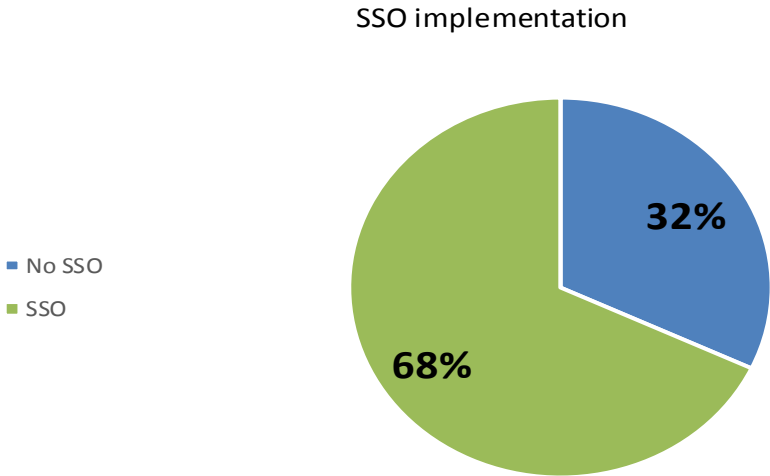
Graph 2. SSO implementation

4. Single Sign-on (SSO)

As we have previously pointed out, 68% of the analyzed countries have developed a SSO system. Out of these SSOs, 39% of them were implemented before 2010 and 14% after 2010 (Graph 3).

SSO implementation date

■ Before 2010 ■ Not available ■ After 2010
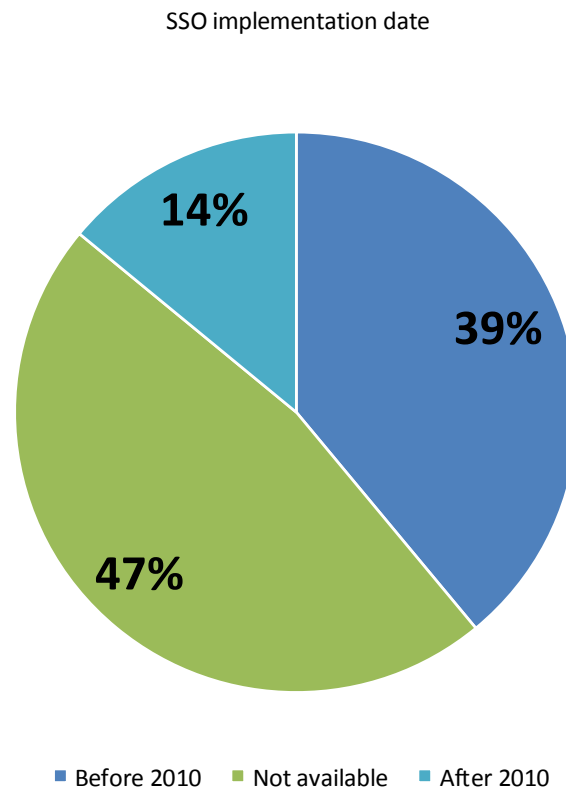
Graph 3. Year of SSO implementation

In order to investigate all of the services connected via SSO, the research team has adopted the "representative basket of 20 services" as described in Digitizing Public Services in Europe: Putting ambition into action, a 9th Benchmark Measurement by European Commission from December 2010 (the European Commission, 2010). This document divides e-services into two main groups – e-services for citizens, or G2C (Government to Citizens, 12 services), and e-services for businesses, or G2B (Government to Business, 8 services). However, at this phase, the research was limited only to the first category of services thus including:

1. Income taxes
2. Job search
3. Social security benefits
4. Personal documents
5. Car registration
6. Application for building permission

7. Declaration to the police
8. Public libraries
9. Birth and marriage certificates
10. Enrolment in higher education
11. Announcement of moving
12. Health-related services

The decision to limit the comparative analysis to the representative 12 G2C e-services was made after the initial environmental scan during which it was found that in some European countries there are myriad of e-services or information about services (not actual e-services) available via governmental portals (e.g. more than 1,500 in Portugal, 453 in Lithuania, 317 in Estonia) and that it would be impossible to achieve meaningful results otherwise.

The research team wanted to analyze how many of the representative 12 G2C e-services were connected through a SSO system in every country that has implemented such a system. On average, seven e-services were connected via SSO. The only country for which we could not find the information on integrated e-services was Slovakia where the list of services is only available, as well as the actual services, after the registration. The most frequently connected G2C e-services in SSOs are: processes related to social security benefits, application for building permission, announcement of moving/change of address, request and delivery of birth and marriage certificates and declaration, notification and assessment of income taxes. (Graph 4). These services seem to use relatively similar sets of data for their processes so it was no surprise why they are at the top of the list. Countries that have connected most e-services through their SSOs were: Croatia, Malta, Portugal (with 12 e-services) and Finland and Lithuania (with 11 e-services).
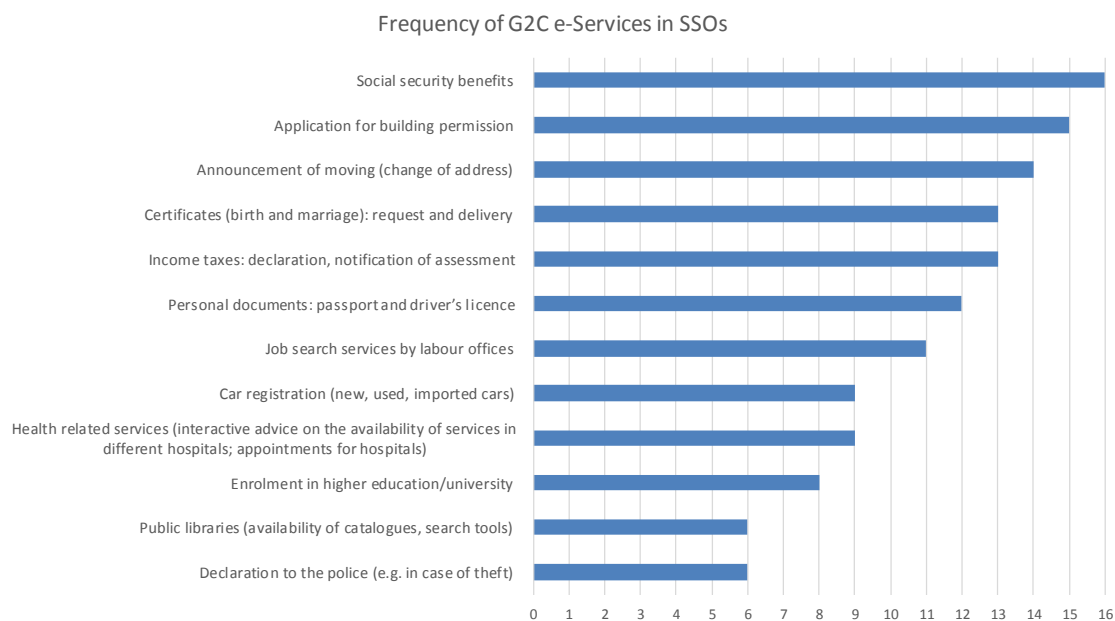

Graph 4. Frequency of implemented e-Services connected via SSOs

Furthermore, the research team has identified 16 different ways of authentication which can be categorized into two main categories:

I. physical authentication
II. virtual authentication

Physical authentication includes eID card, ID card, m-token/mobile ID, signing stick, smart card and token. On the other hand, virtual authentication includes e-certificate, e-mail address, e-signature, username/password etc. which seems to be more commonly implemented (Graph 5). Most frequently implemented way of authentication was the use of username and password (21%) as a virtual form. It was followed by the use of m-token/mobile ID (15%), e-Certificate (13%) and Smart cards (13%) (Graph 6).

Ways of authentication
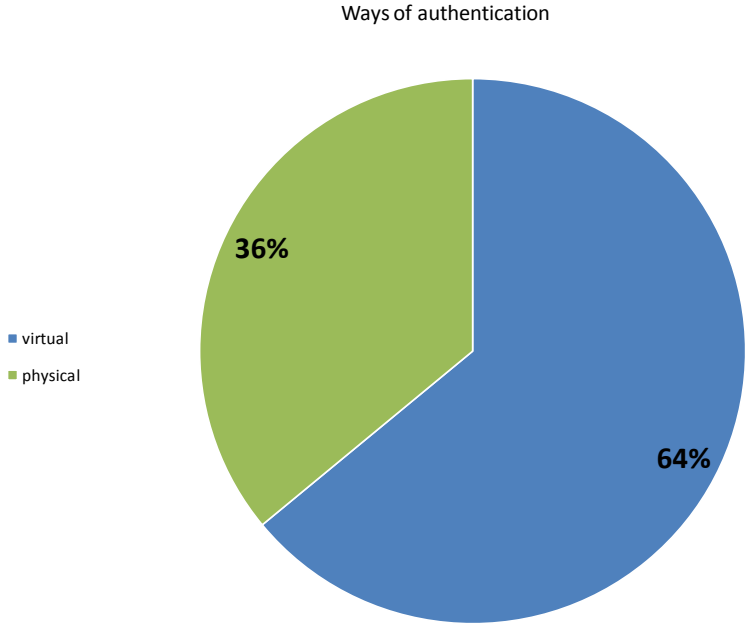
Graph 5. Ways of authenticating users in SSOs

The most frequently implemented ways of authentication
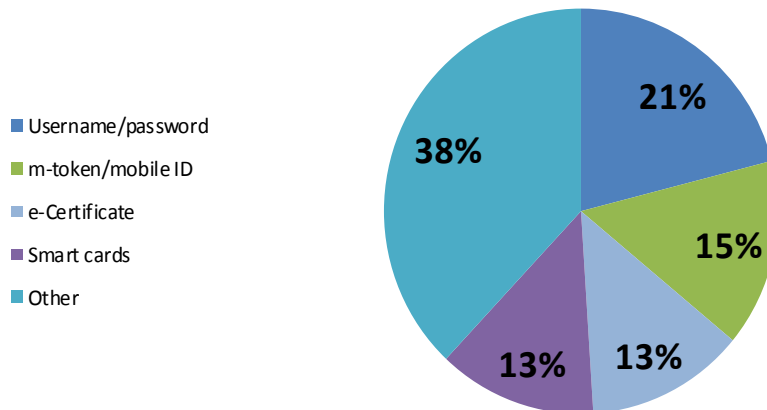
Graph 6. Authentication mechanisms

When searching for different sources of personal information, the research team has identified different identity data governing bodies which can be categorized into six categories and that provide data from all of the 12 G2C e-services. These categories of sources are:

1. National Register
2. Bank
3. Ministry
4. Post
5. Health Insurance Fund
6. Various administrations

5. Trust mechanisms – technical details

Questions regarding technical details of different trust mechanisms provided little-to-no answers in general. However, the research team was able to find some information on federated authentication standards that were being supported and used. Out of 19 analyzed SSO systems only 8 of them had some information on technical details available while only 3 were identified as using SAML. The other identified standards were Liberty Alliance, Shibboleth and XHTML. Also, the team detected some of the encryption levels/standards that were being used. Those were SSL (Secure Socket Layer), TLS (Transport Layer Security), XML Encryption / Signature, and WS-S (Web Service Security).

The research team also wanted to investigate which of the SSO systems were part of the STORK (**S**ecure iden**T**ity acr**O**ss bo**R**ders lin**K**ed) initiative. The aim of the STORK initiative is to establish a European eID Interoperability Platform that will allow citizens to access

different e-services across borders, just by using their national eID. Out of 19 countries that have implemented a SSO, 6 of them (32%) were a part of the STORK initiative – Estonia, Lithuania, Portugal, Slovenia, Spain and the Netherlands.

6. Future plans

Regarding the information on any kind of future plans, only for 7 countries (Croatia, Finland, France, Lithuania, Poland, Portugal and the United Kingdom) the team was able to find some sort of indications of future upgrades. Most of the plans for upgrading the SSO systems can be categorized into three groups:

1. process optimization (e.g. by simplifying transactions, removing constraints etc.),
2. security improvements,
3. technical upgrades (e.g. better compatibility of information systems).

CONCLUSIONS AND RECOMMENDATIONS

The InterPARES Trust project's research "Analysis of the Interoperability Possibilities of Implemented Governmental e-Services (EU15)" built on the research of the previous project "Comparative Analysis of Implemented Governmental e-Services (EU09)" conducted by the same team and analyzed single sign-on (SSO) system in all 28 EU countries by using the developed questionnaire consisting of 29 questions divided into 6 categories – (1) Users, (2) Legal Framework and Strategies, (3) Portals, (4) Single Sign-on (SSO), (5) Trust mechanisms – technical details, and (6) Future plans. The research was focused on investigating 12 G2C e-services available via a national SSO system.

The researchers have found out that there is a room for improvement regarding the development of e-services and their interconnection at the national level of the EU countries since the gap between potential and real users having a broadband connection was identified in more than several European countries.

Based on the environmental scan, literature review and review of relevant official documents, national IT strategies concerning e-Government and e-Government legal texts concerning e-Identification/e-Authentication, the research team carefully formulated a set of questions and incorporated them in the form of questionnaire used later on during the research. After the research, and when the set of questions proved to be sufficient to gather relevant answers, the questionnaire was transformed into the form of a checklist. The checklist is added in the Appendix of this report and can be further used by researchers or records managers assessing SSO systems. Also, it could be used by SSO developers in order to be sure that they have provided enough information on the system they are developing. By making enough information available, we believe that the SSO users will be able to firmly ground their judgments whether to trust an SSO system and interconnected e-Services or not.

It is not only important that the users trust SSO systems – the SSO systems should trust each other and be able to exchange information. This research showed that the European SSO systems are not yet interconnected. At the time of research, the leading project researching in that direction was the STORK 2 project. The main challenge in the coming years will be how to exchange sensitive information in a trusted manner. Illustration of the challenge can be shown by health-related service example of transborder exchange of patients' information between e-health e-services of different countries when a patient of one country needs treatment in another country. Could the patient limit what information a doctor is allowed to access, will the set-up limitation still be valid when accessing the data using another country's SSO, and should there be an "override" possibility for the set-up limitations in case of emergency (e.g. when the patient is not conscious)? Similar situations could surface using other e-services interconnected through national SSO system.

The legal framework should not only follow, but be proactively developed along the technical development in order to set the stage, accommodate and regulate crossborder data exchange and SSO interconnections. Therefore, national legal regulations of the European countries will have to be changed or broadened and then harmonized in order to encompass new situations that will be made possible by interconnecting SSO systems at the European level. It is important not only to view the complexity of SSO implementation from the technical point of view, but also to have defined and clear legal regulations and frameworks on national and transnational level in order to provide fully functional, safe and complete interoperability.

It is recommended to build SSO systems with federated authentication standards using SAML. It is the standard that is most widely used and by using it the developers of SSO systems will ensure compatibility and will make future SSO interconnections easier.

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Note: All links were valid at the time of writing this report.

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Appendix – SSO Checklist

This checklist is based on the questionnaire used during the collection of data for analysis of single sign-on systems (SSO) and their key components implemented in the EU, as a part of their e-government initiatives. Some general questions appearing in the questionnaire are not included in this general SSO checklist because they were relevant for this particular research. The checklist consists of 18 questions divided into 5 categories as following:

1. Legal Framework and Strategies (1 question),
2. Portals (1 question),
3. Single Sign-on (SSO) (11 questions),
4. Trust mechanisms – technical details (4 questions),
5. Future plans (1 question).

This checklist can be used by records managers and archivists when assessing single sign-on (SSO) systems as well as by SSO developers in order to be sure that they have provided enough information on the system they are developing.

	Checklist for Single Sign-On Systems				
	Question	**Y**	**N**	**?[1]**	**Additional info[2]**
1. Legal Framework and Strategies					
1.	Is there a national IT strategy concerning e-Government?				
2. Portals					
2.	Is there a central e-Government portal?				
3. Single Sign-on (SSO)					
3.	Is there a SSO system in place?				
4.	Is the system implemented after 2010?				
5.	How are users authenticated?				
	Username/password				
	e-Certificate				
	eID card				
	e-Signature				
	m-token/mobile ID				
	PIN				
	Single-use code				
	Smart Card				
	Token				
	Other				[Add method]
6.	Is there a physical aspect involved in e-Identification (token, smart card, SIM card ...)?				
7.	Are there one or more levels of access depending on different user's credentials?				
8.	Is there a central identity data governing body? (Central Directory/Register?)				
9.	What is the source of users' identity for obtaining user authentication				
	Social Security Number (SSN)				
	Driver's license				
	ID				
	Passport				
	Other				[Add method]
10.	Are there different terms of use for domestic and foreign users?				

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[1] The "?" column indicates a situation where no information is available or the question is not applicable to your situation.
[2] The "Additional info" column can be used in situations where a simple "Yes" or "No" answer can be supplemented with useful info, e.g. the web address of a central e-government portal, or a link where additional info on the matter in question can be found.

11.	Which services are connected via SSO?				
	Income taxes: declaration, notification of assessment				
	Job search services by labor offices				
	Social security benefits				
	Personal documents: passport and driver's license				
	Car registration (new, used, imported cars)				
	Application for building permission				
	Declaration to the police (e.g. in case of theft)				
	Public libraries (availability of catalogues, search tools)				
	Certificates (birth and marriage): request and delivery				
	Enrolment in higher education/university				
	Announcement of moving (change of address)				
	Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)				
12.	Is there a possibility of log-on to a connected service without using SSO, i.e. by accessing their web-site directly and using their log-on service (different credentials from SSO credentials)?				
13.	Is it possible to obtain an e-document from one e-service and send it to another e-service via safe transfer methods – safe document transfer?				
4. Trust mechanisms – technical details					
14.	Are there some federated authentication standards supported and used (e.g. SAML)				
15.	Does the system require digital signatures? If yes – which type(s) – standard or advanced, XMLDSig, XAdES etc.?				
16.	Is it possible to achieve protocol interoperability (LDAP)?				
17.	Is the SSO a part of STORK initiative?				
5. Future plans					
18.	Are there any plans in place for future Identity Federation solutions				