Enterprise Architecture for International Agreements in Social Security Institutions

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Abstract: This paper analyzes the problems associated with the implementation of international agreements in social security institutions. International social security agreements aim at protecting social rights of migrant workers by enabling the portability of social benefits, which involve managing billions of dollars paid worldwide by the signatory countries. This involves significant cross-border data exchange and back-office information processing. The effective and reliable implementation of agreements, therefore, requires an intensive application of information and communication technology (ICT) to ensure the integrity of the process. In this paper, a series of enterprise architectures were presented that will help the designers of the systems of social security institutions to carry out the international agreements.

1 INTRODUCTION

Social protection aims at reducing the vulnerabilities and economic risks of individuals, households and communities. This is done through different social security schemes, such as old-age and retirement pensions, family benefits, in-kind benefits for health and medical services, occupational accidents, etc. In order to be entitled to these benefits, people have to contribute to the scheme or to general taxes depending on the type of social security system. The protection of these social rights for migrant workers requires, among different measures, ensuring equal treatment and maintenance of rights acquired or in the process of being acquired with respect to local workers in host countries.

International social security agreements constitute a key legal instrument that enable the portability of social rights for migrant workers by ensuring that periods of employment are taken into account for granting benefits in the signatory countries. International agreements also aim at preventing the "double contribution" of temporary workers in a host country, enabling costs savings without reducing social protection.

The application and operation of social security agreements is based on the exchange of data between the signatory institutions (e.g. information on work periods in a country, dates of temporary relocation, etc.) and, to a certain extent, the way in which an international social security system operates based on a signed agreement. While most of the international social security agreements are bilateral – i.e. concluded by two countries – there are multilateral agreements allowing several countries to coordinate parts of their social security systems.

Although the main involved technologies are well known, especially Interoperability, the implementation of such mechanisms remains challenging and most of the international agreements are based on manual document paper exchange. The main implementation complexities concern the definition of common architectures as well as using Semantic Interoperability to deal with conceptual and linguistic mismatches among the signatory parties. Furthermore, such implementation requires solving the coordination between the internal institutional systems from different countries without a predefined standard.

A series of guidelines have been developed to help social security institutions implementing the operational aspects of international agreements by using information technologies (ICT) (ISSA, 2016) focusing on interoperability, data exchange processes and related functions. Furthermore, the Semantic Interoperability issues which have been addressed in

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(Delgado et al., 2013) and (Delgado et al., 2014). Nevertheless, the issues of defining common architectures for supporting international data exchange have been less treated.

This paper addresses main issues on managing international social security agreements and for developing related computer systems. Concretely, this paper proposes a series of enterprise architectures to help developing these systems.

The rest of the paper is organized as follows. Section 2 presents the social protection instruments for migrant workers (i.e. the international agreements). Section 3 describes the Interoperability framework underlying the proposed solutions. Section 4 presents Enterprise Architectures for implementing the agreements. And Section 5 concludes and depicts future work.

2 INTERNATIONAL SOCIAL PROTECTION FOR MIGRANT WORKERS

Governments are increasingly obliged to collaborate across organizational, sectoral and administrative boundaries (Janowski et al., 2014). In order to protect the social rights of migrant workers, the International Labor Organization (ILO) has developed a set of recommendations and standards. These recommendations define five basic principles that form the backbone of most bilateral and multilateral social security agreements:

- Equal treatment.
- Determination of the applicable legislation.
- Maintenance of acquired rights and the provision of benefits abroad.
- Maintenance of the rights in course of acquisition.
- Reciprocity.

International social security agreements establish a legal framework to coordinate the plans of the countries involved. Most of the agreements are bilateral, as it is established between two countries in order to coordinate their specific regulations. However, there are some multilateral agreements that allow several countries to coordinate the parts of their social security systems. Where there is no bilateral or multilateral agreement covering nationals of certain countries, the host country may establish unilateral measures to provide social protection to migrant workers.

Agreements are documents structured generally in sections and articles following ILO recommendations No. 167 (ILO-R.167, 1983).

The application of social security functions through international agreements involves the processing of two main types of operations: (i) requests for information from other institutions participating in the agreement required to process a benefit claim (i.e. other liaison bodies), (ii) claims for benefits submitted by individuals (workers and retirees); the latter probably requested information from the liaison institutions of the countries in which they worked. Therefore, the exchange of data with other liaison bodies are key tasks in the implementation of social security agreements.

At the global level, the overall implementation of a social security agreement involves several steps and different types of activities. On the one hand, dealing with political and legal aspects involves conducting preliminary negotiations preparing the text of the agreement, signing and ratifying the agreement, including administrative arrangements, and defining when the agreement will begin to be applied (entry into force) (Hirose et al., 2011). On the other hand, the organizational aspects involve the establishment of administrative procedures for the processing of applications and related operations, as well as the definition of roles and responsibilities related to these tasks (ISSA, 2016).

The implementation of the agreements also requires the definition and preparation of the mechanisms to carry out the exchange of data with the other liaison institutions. This includes defining the format and semantics of the data being exchanged, the authentication mechanism (e.g., electronic signature), the protocol for request-response exchange and maximum delays, etc.

The data exchanged consists mainly of the following: (i) workers‘ personal data, (ii) the previous worked periods grouped by employer and labor categories relevant to the agreement, (iii) the future work periods of detached workers as well as the origin employers, (iv) death and family status certificates, (v) partial or total medical records if the agreement relates to health benefits, (vi) periods of residence for countries with a universal social security system where benefits’ eligibility is based on them rather than worked periods.

Data exchanges must comply with security, privacy and authentication rules. On the one hand, social security agreements usually include data protection clauses. On the other hand, the validity of administrative procedures depends on the authenticity of exchanges that can be made only by

authorized personnel (electronic signature of an authorized person).

The operations of the agreements also include the payment or entitlement of benefits to the people, as well as the suspension or cancellation according to personal, family or employment changes.

2.1 Managing International Agreements: General Description

Signing an international agreement involves the country's institutions to comply with its terms and conditions. This includes the implementation, management and application of the terms of the agreement to individual cases, which involve persons formerly resident or workers in at least one of the signatory countries, as well as individuals who are going to reside or to work in them.

The type of management will depend on the content of the text agreed by the governments of the involved countries, although this management usually focuses on: (i) providing information on the personal situation of original workers who will work or have worked in one of the signatory countries, (ii) agree or deny benefits under the agreement, (iii) register temporary detached workers.

On the other hand, each signatory institution should define the main actors involved in the management of international agreements, in order to ensure that management is carried out with certain levels of quality.

In a first level the main actors and roles identified are: (i) the Central Government, the Ministry and Parliament at the time of signature and ratification of the agreement, (ii) the "liaison" institutions that carry out the international coordination of the agreement with their counterparts in the other signatory countries, (iii) the "competent" institutions which are responsible for the practical implementation of the agreement and which will implement the management functions and processes. These institutions are those which administer the social security schemes provided in the agreement, (iv) persons requesting benefits and related information under the agreement and (v) companies that declare workers on a temporary regime.

Signatory organizations should identify the main processes, responsibilities and requirements of governance and quality. Therefore, the agreements establish the management and decision-making framework, establishing the "liaison" and "competent" institutions in the signatory countries.

At the international level, management should be based on the provisions of the agreement. For this reason, the basic processes that ensure the exchange of data and communication of resolutions between different institutions and countries are defined.

Finally, the institutions should implement auxiliary processes in which a notifications system of changes in work and personal situation, as well as the technological needs necessary to guarantee the correct exchange and understanding of the information, are established.

3 INTEROPERABILITY

In this section, we will explain the levels of interoperability presented in the European Interoperability Framework (EIF) (European Commission, 2009, 2017) adapted to the international social security agreements.

Legal: consists of the international social security agreements themselves, as well as the relevant legislation of the participating countries so that the information sent has adequate recognition in the "receiving" country. This includes definitions and agreements designed to articulate the jurisdictions, mandates and responsibilities of the organizations involved in the exchange of information. Operational (administrative) agreements that formalize the ways in which the exchange of information will take place are also counted.

Organizational: refers to the way in which business processes are modelled in order to support social security operations. Organizational interoperability consists of specifying the processes that involve the information exchange operations and the connection of the participating organizations. These processes must be compatible with organizations and comply with legal declarations of interoperability.

Semantics: ensures that the precise meaning of the information exchanged is understandable for any other application not initially developed for this purpose. Semantic interoperability allows systems to combine information received with information from other sources and process it in a coherent way.

One of the main problems faced by institutions in applying automatic data exchange between two systems is to ensure that the receiving system will interpret information in the same way (i.e. with the same meaning) as the sending system. This is the fundamental issue addressed by semantic interoperability.

Achieving this requires agreeing, for example, on how the data and its context are represented. This is what will allow the automatic tools to share and

process information, even when it has been registered independently. The goal of semantic interoperability is not only to allow the interconnection of information resources, but also to be understood automatically and as a consequence be reused by computer applications that are not involved in its creation.

Given the linguistic heterogeneity between countries participating in the exchange of social security information, as well as the lack of terminological standardization in the area, semantic interoperability is the weakest dimension of social security interoperability systems.

Technique: covers aspects of connection and communication between software applications and computers. These are key aspects such as open interfaces, interconnection services, data integration and middleware, presentation and data exchange, resource localization and recovery, accessibility, security and integration of applications and services. Different standards and specifications of extended use can be identified for different areas (interconnection, data exchange, presentation of information, etc.).

The maturity of the Internet and associated web-based technologies (e.g. web services and SOA) has made application and process construction much more practical in recent years and allowed to cross national boundaries.

Technical interoperability for the exchange of social security information mainly consists of rules on: service architectures that provide a common interaction model for the service-oriented system, data models that enable the parties to decrypt and use exchanged data, interconnect And middleware technologies that enable global interaction.

4 ENTERPRISE ARCHITECTURE

This section describes Enterprise Architectures specifying the connections between the different parties involved in the implementation and operation of international social security agreements. To represent the enterprise architecture, ArchiMate (The Open Group, 2017) together with EIRA (European Commission, 2017) specification have been used.

The implementation of international agreements requires reliable mechanisms for data exchange among the involved institutions. This includes, among other matters, defining the data to be exchanged, the authentication mechanism (e.g. electronic signature), the protocol for request-response exchanges specifying maximum delays, as well as implementing the ICT-based systems to support these operations.

Moreover, it also involves carrying out the daily operation of the agreement, through automated processes to the greatest extent possible, which mainly consists of receiving and sending information and notifications of changes as well as processing benefits claims.

As the operational tasks involve cross-border data exchange and information processing, intensive usage of ICT is necessary to achieve effectiveness and reliability in the application of the agreement.

In spite of the increasing application of ICT in social security, the ICT-based implementation of international agreements remains challenging. The lack of standards on data and processes is the main reason. In addition, the complexity of developing inter-institutional and cross-border systems constitute a barrier for implementing ICT-based systems supporting international agreements.

The overall implementation of international social security agreements involves stakeholders whose roles are usually mentioned in the texts of the agreements. The following definitions provide the context in which they are used:

- Competent authorities refers to the ministries authorized under the social security legislation of a party participating in the agreement to administer that legislation.
- Liaison agencies (or liaison institutions) refers to the organizations that ensure the coordination and exchange of information between the institutions of the parties participating in the agreement. Countries may define one or more liaison agency for all the different matters covered by an agreement.
- Competent institutions refers to the institution(s) responsible for administering the legislation to which the agreement applies, particularly social security schemes. Many agreements use the generic phrases “the competent authority” and “the institution which is competent according to the legislation applicable”.

This section addresses the definition of architectures, specifying the main ICT components that enable the implementation of interaction between institutions putting into practice international social security agreements.

The implementation of agreements involves three levels of architecture (fig.1):

- International architecture, which addresses interaction at the international level between liaison agencies of different countries;

- National architecture, which addresses interaction at the national level between the liaison agency and competent institutions in the same country;
- Institutional architecture, which addresses the interaction of institutions' internal ICT systems with the other entities at the international and national levels.

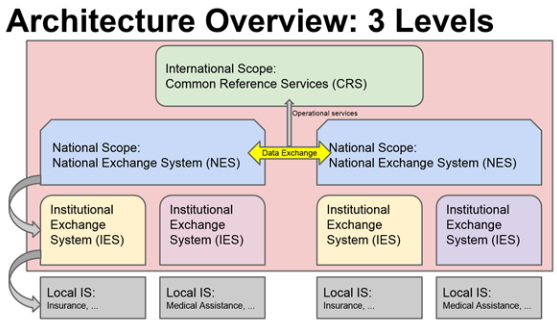

Figure 1: Architecture overview.

The architecture applies to specific agreements and depends on the characteristics of the agreement. While the international architecture of multilateral agreements requires common services and a "trusted third organization", bilateral agreements could be based on point-to-point connections between the liaison agencies (e.g. using Web Services protocols).

In turn, the national architecture applies only when there are several national institutions coordinating with each other; it is not necessary when there is only one institution involved in the agreement, which is a very frequent scenario.

4.1 International Architecture

At the international level, agreements must carry out a systematic, standardized and secure exchange of data between the institutions of the different participating countries.

Likewise, it is a question of providing a repository where the parties can maintain information of common interest on the development of the agreement.

The use of this repository in multilateral agreements is recommended, and may be administered by a trust entity of the participating institutions. In the case of bilateral agreements, this information may be administered by the two participating institutions or countries. They could also follow a similar model to multilateral agreements with a trust entity to administer the repository corresponding to several bilateral agreements.

Therefore, at an international level, an architecture with Common Reference Services (CRS) is proposed to maintain the basic elements for institutions to interact in compliance with safety parameters, interoperability agreements and services under an international agreement with a single structure:

- The agreements define a common service model for the different parties to coordinate their work and efforts in their implementation, embodied in the Common Reference Services - CRS.
- The institution will appoint a Responsible Technical Committee (RTC) to oversee, maintain and manage international agreements.
- The RTC coordinates the operation of the agreements of the institution with the liaison agencies, establishing the specific model of the interoperability admitted in the agreement.
- The architecture should provide security features, authorization and non-repudiation of operations, and maintaining traceability services.

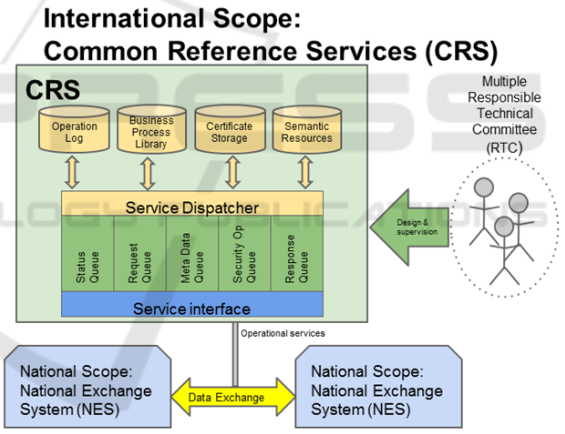

Figure 2: International architecture overview.

The main resources to be administered at the international level are:

- Log of operations, which provide traceability to operations.
- Deposit of certificates and digital signatures, which allow to authenticate the operations carried out.
- Semantic resources and Metadata, which facilitate the correct interpretation of the data exchanged.
- Process Library, which defines the processes to be developed.

The objective to be achieved with semantic resources is to describe the information that is

exchanged, in terms of concepts, their properties and the relationships between these concepts. To achieve this, a common metadata scheme must be established. Since the properties of a concept may have different values, it is convenient to use controlled vocabularies. If you want to achieve richer semantic levels you can use taxonomies and ontologies, which define the concepts of a given domain as well as its relationships.

Also, to implement Organizational Interoperability (at the process level), it is necessary to have the Shared Process Library in the CRS at the international level.

Figure 3 shows the architecture at the international level using the ArchiMate and EIRA specifications.

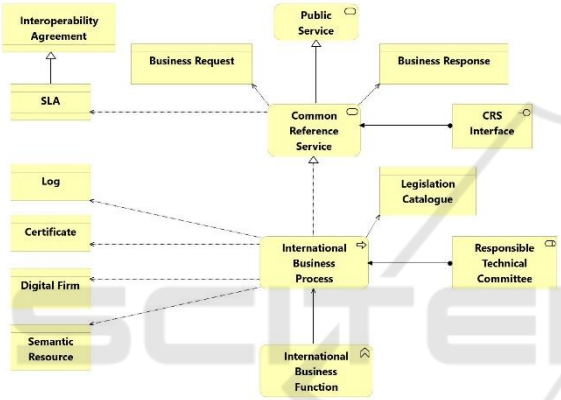

Figure 3: International Enterprise Architecture with ArchiMate and EIRA.

At the international level, a series of business processes must be carried out, which could be divided into a set of business functions. Business processes will use business objects such as logs, certificates, digital signatures and semantic resources. Responsible for managing these business processes will be the Responsible Technical Committee.

The business processes will be executed through a series of services reflected in the Common Reference Services (CRS). These services will expose their functionality through interfaces and will use a series of business objects such as requests (requests received), responses (to such requests) and SLAs.

In addition to the ArchiMate elements explained, a number of EIRA elements have been used. First of all, it is understood that CRS are public services, so we have a relationship of inheritance between them. Subsequently, the CRS SLAs will be a specialization of interoperability agreements agreed between the different countries involved in the agreement. Finally, international processes will use a legislative catalog.

4.2 National Architecture

The national level corresponds to the coordination of multiple institutions from the same country participating in an international social security agreement. Therefore, when you have a single participating institution in a country, this level tends to merge with the institutional level.

At the national level, the technological infrastructure should be compatible with an architecture of communication between the liaison body of international agreements and specialized national agencies or institutions, with the structure shown in Figure 4.

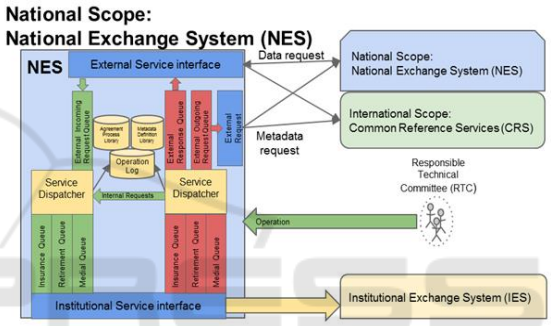

Figure 4: National architecture overview.

The main features are:

- The institution, through the Responsible Technical Committee (RTC), defines access methods and queries based on an SOA architecture for communication with other liaison agencies.
- The RTC defines service level controls (SLAs) to provide agreement and establish control mechanisms over the architecture.
- The national process request architecture will receive multiple requests adapted to the national structure of the local Social Security system. The installation of the access point is named National Exchange System (NES).
- The national architecture must construct an adequate response based on the responses of the information system of the local institution.
- The national architecture should provide a method for creating requests to other liaison bodies within the framework of the international agreement.

- The national architecture can integrate some functions of international scope in the bilateral agreements.

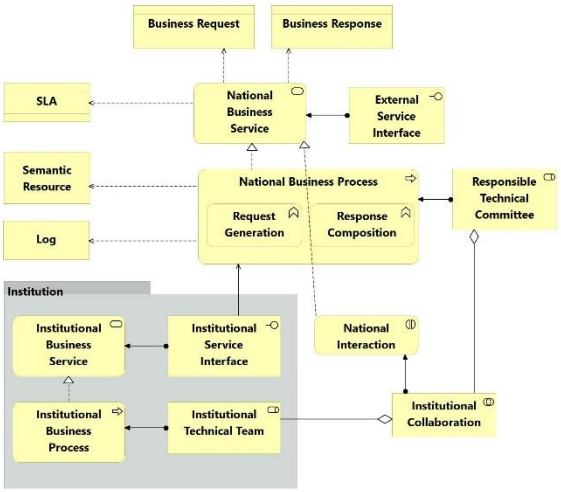

Figure 5: National Enterprise Architecture with ArchiMate and EIRA.

At the national level, a series of business processes must be carried out, divided into two main business functions, such as the generation of requests and the composition of responses. Business processes will use business objects such as logs and semantic resources. Responsible for managing these business processes will be the Responsible Technical Committee.

The business processes will be executed through a series of services reflected in the National Business Services. These services will expose their functionality through interfaces (External Service Interface) and will use a series of business objects like requests (requests received), answers (to such requests) and SLA.

The processes at the national level will be carried out by various institutions of the country (will be explained in the next level). These institutions have to collaborate to be able to carry out the business processes. For this reason, it has been represented by the element "Institutional Collaboration" which represents the collaboration between different technical teams of the Institutional Technical Team. These collaborations are represented by the "National Interaction" element that represents their collaborative behavior at the business level.

4.3 Institutional Architecture

At the institutional level, the architecture should serve as an adapter for acceptance and, with corresponding authorization, the processing of requests for information covered under the international agreement (Figure 6).

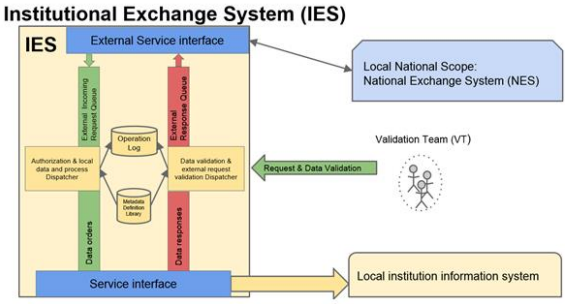

Figure 6: Institutional architecture overview.

The proposed architecture integrates operations at the international level with the institution's internal systems not directly, but through mechanisms that allow the institution to control the incoming flow of requests from other institutions as well as the outflow of information.

The main features are:

- Each Institution making up the National Social Security Systems should have its own Institutional Exchange System (IES) for the reception, authorization, management and response of requests for information received from the NES (National Exchange System), and sending requests for information to other liaison agencies.
- The Institution must appoint a validation team (VT) for the authorization and control of the applications received through the IES. The VT, using the data received from the IES, adapts the requests to the local data structure so that the institution only provides adequate data as specified by the data established in the international agreements.

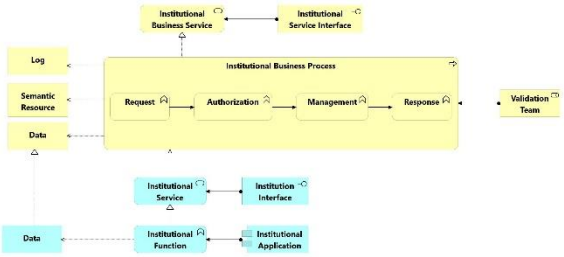

Figure 7: Institutional Enterprise Architecture with ArchiMate and EIRA.

At the institutional level, a series of business processes must be carried out, which will be divided into main business functions such as the processing of

requests, their authorization, management and response. Business processes will use business objects such as logs, semantic resources, and a series of data to complete the requests. The Validation Team will be responsible for managing these business processes.

The business processes will be executed through a series of services reflected in the Institutional Business Services. These services will expose their functionality through interfaces (Institutional Service Interface).

The business processes will be developed in each institution with a number of elements at the application level. The institutions have a set of applications that will offer a series of functions and they will be accessible through services with their corresponding interfaces. These applications will use data for processing.

5 CONCLUSIONS

The implementation of international social security agreements requires an intensive use of ICT at different levels: international, national and institutional. Furthermore, it is imperative that the information exchange between social security institutions is carried out in a secure and coordinated manner. While each institution has their own information processing systems and business procedures, the interoperability mechanisms play a key role to interconnect them in order the international agreements.

This paper addresses the involved issues, particularly the interoperability ones, and proposes a general enterprise architecture that allows the development of interoperable systems at the international, national and institutional levels. Through these architecture levels, it is a matter of guiding the designers of the computer systems in charge of carrying out the international agreements. The architecture levels provide a series of basic elements that will be part of these systems but without going into specific details related to the internal processes to be applied. It has been presented in a general way to make it easier to implement or adapt to the different technologies used by social security institutions.

The main contributions of the paper are the specification of these three architectures in coordinated way tacking into account characteristics of the social security area. In addition, the use of ArchiMate has allowed to formalize the enterprise architecture and together with EIRA, elements of interoperability between public administrations can be represented.

Future work would consist of more detailed specifications, formalization and prototyping.

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