

OP SIS: An Open, Preventive and Scalable Migration Information System

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Abstract. Existing research initiatives and migration-oriented automated tools and services fail to provide a complete, robust and widely available framework for collaborative development of a common pan-European migration policy and the harmonization of processes and civil status documents formats. Identifying these weaknesses and based on advanced open-source technologies and interactive software tools, we propose an Open, Preventive and Scalable migration Information System, namely OPSIS, that is able to provide a consistent framework for collaboratively harmonizing common migration policies, procedures and data formats related to civil status documents.

Keywords: Migration Information Systems, harmonization, collaboration.

1 Introduction

In recent years of globalization and free-movement, the heterogeneous national migration proposals, policies, practices and procedures become stumbling blocks for implementing a common, balanced, European civil migration policy. Thus, the 18,5 million¹ legal immigrants residing in Europe is an economic non-exploitable asset with major consequences in growth and employment. Aiming at reversing this disappointing situation and ensuring Europe's prosperity, an emerging requirement for policy and decision makers is to collaboratively contribute towards strengthening on one hand the facilitation of legal immigrants to enter and move freely in the European labour markets and on the other, the fight against illegal immigration, smuggling and trafficking of human beings.

Legal, political, technological and societal differences in the Member States as well as the inability of all possible stakeholders to interactively and persistently collaborate in a synchronous manner, leading to their isolation from decision making processes and the formulation of balanced migration proposals, are the main causes blocking the adoption of a common, acceptable, and applicable pan-European migration policy. Therefore, an urgent need is implied for effective, collaborative actions engaging migration

* Eurostat 2008.

policy makers and public administrators in order to identify, model, analyse, monitor and harmonise balanced national migration policies, proposals and practices.

The proposed system, OPSIS, responds to this need since it is a centralized collaborative, balanced migration information tool based on existing standards and open-source software technologies. Offering a user friendly interactive and robust collaboration framework OPSIS constitutes an innovative prototype through which: Public administrators (e.g. Ministries of Interiors, Police, and Municipalities) can report, identify, model, analyze and reengineer their national migration policies, specific procedures, data formats and their organizational structures; Policy and Decision makers (e.g. European Agency of Migration Policies, European Agency for the Management of Operational Cooperation at the External Borders) can monitor and benchmark national practices, build harmonized E.U. procedures, processes and data formats, identify ongoing (legal, security, privacy, organizational, political) gaps and barriers at E.U. level building a common E.U. migration policy; IT developers can be guided upon the necessary governmental processes, procedures and data formats in order to build interoperable, secure, cross border e/m-government services. Thus, OPSIS tool is able to improve migration policy harmonisation processes.

The rest of the paper is organized as follows: Section 2 describes existing research projects and automated migration tools illustrating their deficiencies. In Section 3, all required core design principles are identified, specifying their implementation. Section 4 provides a descriptive OPSIS system architecture overview analyzing its basic components. Finally, Section 5 draws conclusions and provides future research directions.

2 State of the Art

Non-homogeneous migration policies, practices and procedures along with organisational, legal, technological, societal and political differences are main stumbling blocks for E.U. governmental organisations to: monitor, trace and audit illegal movement; legal citizens to practice their civil right to move freely or seek employment in the region and finally to create a common European migration policy.

Recently, several projects have been launched to research and elaborate on the existing problematic situation while the implementation and adoption of Migration Information Systems (MIS) is emerging slowly. Action and development programs funded or co-funded by the E.C. such as the EC-UN Joint Migration [1] and ARGO [2] as well as research projects like Euromed Migration II [3] and those under the MARRI Initiative [4], are mainly aiming at promoting administrative cooperation and supporting civil society organizations and local authorities. Generally, their objectives are to bring together practitioners and further develop networking and partnerships, usually by conducting training actions and staff exchanges, studies, conferences or seminars. Furthermore, PROMNISTAT [5] and DCIM-EU [6] projects focus on the establishment of comparable indicators for data collection on migration issues while the objectives of ERLAIM project [7] are policy-oriented, providing awareness for the integration of immigrants by exchanging good practices, policies and experiences.

Identifying the continuously evolving nature of migration issues as well as the need for adopting automated procedures and widely available technological tools in order to facilitate in a more holistic way the development and future advancement of common

migration policies, more sophisticated initiatives have introduced a number of software tools in order to enhance traditional ways of migration information diffusion and exchange. Representative example is MIPEX [8] that provides informative national reports and comparative statistical data, as well as the web-based services offered by the European Civil Registry Network [9] and the Information Exchange System of European Migration Network (EMN) [10] whose main objective is the exchange of Civil Acts documents and other relative data. On the other hand more generic approaches such as the Policy Mix Web Portal [11] and the Common Assessment Framework (CAF) [12] constitute significant sources of information and experience for further analysis and possible interrelation with migration issues.

Unfortunately, most of these tools are isolated and none of them are interoperable with other IT migration systems and collaborative/interactive with the decisions makers so they can use them persistently in order to monitor, analyse, reengineer or harmonise their migration procedures, and processes supporting their national migration policies.

Consequently, there is an urgent, acknowledged need for more holistic and effective collaborative actions among Member States in order to harmonise national migration policies and specific migration procedures adopting more sophisticated methods by fully-exploiting the existing technological advancement. This paper proposes the OPSIS tool, a collaborative, migration information system that provides the opportunity to all stakeholders to identify, model and analyse national migration policies and practices as well as to monitor and harmonise easily procedures and data formats, thus accelerating their efforts towards a common European migration policy.

3 OPSIS Core Design Principles

The fundamental benefit of the OPSIS platform is the consistent usage of a standards-based architecture, which integrates easily modified and expanded functionality, and re-engineered services, adopting the following core design and implementation principles.

Modularity: In OPSIS every module is a component of a larger system, and operates within that system independently from the operation of the other components. Consequently, OPSIS is able to decompose an operating problem into a small number of less complex sub-problems, which are connected by a simple structure, and independent enough to allow further work to proceed separately on each item. This way the effect of an abnormal condition, which occurs at run-time in a module, remains confined to it, or at worst it only propagates to a few neighboring ones.

Open Standards, Technologies & Specifications: A primary requirement when designing and implementing the OPSIS prototype was the minimization of costs not only for the current integration but also for every future improvement, due to the fact that governmental organizations (GOs) usually lack of financial resources and IT well trained personnel. Besides, private companies are typically compelled by the realities of profit making, while G.O.s do not have such profit-oriented motivations. Essentially, OPSIS adopts peak technologies and worldwide accepted and mature standards in order to build an *Enterprise Application Integration (EAI)* and Technology framework, providing advanced migration-based services according to *Software-as-a-Service (SaaS)* model [14].

Interoperability: Interconnecting many distributed and heterogeneous enterprise systems, is a difficult task, requiring easily identifiable and publishable e/m-services, as well as interfaces for the establishment of secure and reliable connection points [15]. Interoperability among the core entities of *OPSIS* was achieved by adopting WSs as the core communication protocol, and advanced XML-based technologies. A main difficulty being dealt with was to find a universal and standardize way to interoperate with the different kinds of applications and tools, which adopt the following characteristics: *Proprietary interfaces, Limited communication protocols, Lack of scalability.*

Therefore, in order to achieve interoperability we built a *Middleware Layer*, which integrates truly interoperable mechanisms through the use of an open source *Enterprise Service Bus - ESB* framework [16]. OPSIS ESB is a light weight messaging framework that uses disparate technologies, transports and protocols. It manages all interactions between the various components transparently, stipulating that different components of applications communicate through a common messaging bus [17]. Moreover, semantic interoperability among the different migration-based systems is handled by using standard based ontologies proposed and developed in the platform, based mostly on existing European ones.

Scalability & Extensibility: Advanced enterprise solutions demand the creation of a dependency between business and information technologies in order for GOs to be able to maintain scalable and extensible systems that efficiently support their business activities. OPSIS allows the abstraction of proprietary applications through the use of adapters, brokers, and orchestration engines. The resulting integration architecture is more robust and extensible, especially with the advent of the open Web Services framework and its ability to fully abstract proprietary technology. The use of BPMS systems for modeling all business processes in the core enterprise, organizes the embedded logic of an application into separate and easily changed “state machines” [18]. Adopting JBoss jBPM [23], in order to orientate the integrated migration-based services, our primary goal was to establish a highly agile automation environment, fully capable of adapting to change, which is realized by abstracting the business process logic into its own tier. Thereby, we are able to alleviate other services from the need to repeatedly embed process logic, and support process optimization as a primary source of change for which services can be recomposed.

Reusability: The goals behind service reusability are tied directly to some of the most strategic objectives of service-oriented computing, which are strongly supported by OPSIS. These objectives have as follows: Allow for service logic to be repeatedly leveraged over time so as to achieve an increasingly high return on the initial investment of delivering the service; Increase business agility on a migration-based level by enabling the rapid fulfillment of future business automation requirements through wide-scale service composition; Enable the realization of agnostic service models; Enable the creation of service inventories with a high percentage of these agnostic services.

Addressing this principle was very important when designing and implementing our prototype and its enterprise systems. Rather than embedding functionality that should be deployed across every specific government service, the distributed OPSIS architecture offers advanced and reusable security, storage and Web Services interfaces to application developers in order to easily expand its functionality and build upon it. Our main focus

was to offer an innovative framework, in which all essential functions can be easily re-used, configured and customized in every e/m-service provided.

4 OPSIS System Overview

In order to address its objectives and accomplish its mission the OPSIS system overall architecture, as depicted in Figure 1, encompasses the following core participants and entities distributed in four distinct layers as follows:

Layer 1 – OPSIS end-users: This first layer consists of the three groups of users mentioned in section 1, namely, *Public Administrators*, *Policy and Decision Makers* and *IT developers*. Additionally, public administrators are responsible for properly and adequately providing initial content to the system and specifically all the primary information assets comprised at Layer 2 of its architecture, that are necessary for harmonizing migration procedures and civil status documents formats, decision making and policy design.

Layer 2 – OPSIS Primary Information Assets: The OPSIS Primary Information Assets (Figure 1) include the following: Council Directives and Decisions, E.U. Directives and Decisions, E.U. and National Migration Policies, National Migration Procedures and Processes, Civil Status Documents, National and E.U. Mandates, Related Legislation and Policies as well as identified Best Practices.

Layer 3 – OPSIS services: Through the use of the portal the end-users are able to gain access to advanced OPSIS electronic services, as follows:

- *Information Asset Management:* Public administrators are enabled to create and insert to the OPSIS tool migration policies, Directives, practices, procedures, structures and processes. In addition all OPSIS end-users are able to search and browse these information assets, as well as monitor and track changes applied to them in a controlled way. All these activities are supported and provided by the integrated tools of the OPSIS content management component described in subsection 4.1.
- *Governmental Process Modeling:* Public administrators and policy or decision makers take advantage of this service in order to model, further analyse and appropriately manage the information assets contained in the OPSIS platform through the use of a graphical environment capable for interactively designing processes. This service is provided through the Decision Support component and specifically from the integrated Governmental Process Modeling and Management tool.
- *Benchmarking and Assessment:* The end-users of this service are also the public administrators and the policy or decision makers who are enabled to benchmark national practices, policies and procedures, as well as to perform assessments on these assets, in terms of legislation, organizational, political, and security characteristics, in order to identify gaps with respect to E.U. directives and best practices. This service also enables end-users to reengineer their current internal affairs.
- *Semantic interoperability guidance:* IT systems developers and integrators are guided of how to use semantically aware schema definitions in order to build the

basis for an E.U-wide standardisation in migration area. This semantic knowledge is shareable among systems to enable collaborative evolution of National and European ontologies on migration assets. Specifically, this service is provided through the use of properly configured ontology engineering and mapping tools that enable the establishment of a common definition and understanding of migration issues, processes and data formats.

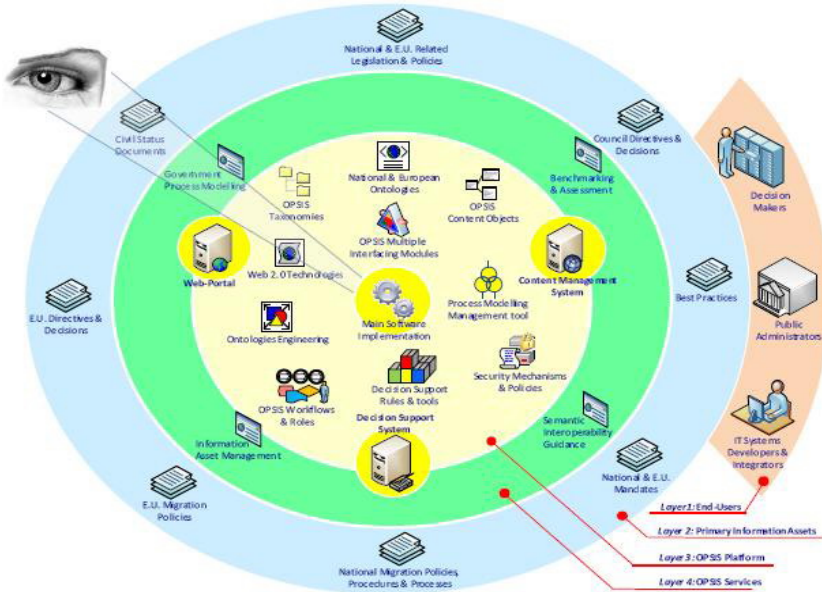


Fig. 1. OPSIS Platform Overview

Layer 4 – The OPSIS Platform: Based on open-source solutions and technologies, the core platform of Odysseus consists of three main components:

- *The Content Management System* which undertakes the creation, editing, management and publishing of all the migration-based primary and processed content in a consistently organized fashion.
- *The Decision Support System*, which intends to help public administrators and policy makers to compile useful information from primary raw data, documents, national and E.U. knowledge, and migration decision makers to identify, solve problems, and reach decisions.
- *The Web Portal*, which provides electronic and mobile based point of secure access to OPSIS services, information, and content, retrieved and processed from diverse sources, in a unified and user-friendly way.

4.1 OPSIS Content Management System

The OPSIS CMS, apart from integrating storing, controlling, versioning, and publishing advanced mechanisms and functions, it is responsible for: Defining workflow

tasks for collaborative content creation with the use of Web 2.0 technologies (wikis, forum, blogs, etc); Tracking, capturing and publishing public content to different repositories.

As every synchronous content management system it contains a set of multiple tools and information assets as depicted in the following figure. The OPSIS CMS holds the OPSIS taxonomies, the XML-based and e-Gif enabled content objects, and the related tools for the effective collection of data as well. The OPSIS taxonomies considered several previous efforts, compliant with world-wide standards such as the ISO-2788 [19] and BS-8723 [20]. Among these were the *Integrated Public Sector Vocabulary (IPSV)*, the *Taxonomy of Human Services*, the *European Communities Glossary*, and others. Correspondingly, the structure of the OPSIS content objects is based on the Greek and the British e-Gif specifications [21] in order for the framework to enable the seamless flow of information assets and to provide a long term strategy that will be able to adapt in the future. In addition it provides:

- Advanced *content management tools* such as rich text editors, live page editing and scheduling, and advanced document managers.
- *Web 2.0 technologies* with their own set of authorizations, message boards for facilitating conversations around public administration aware topics, blogs for allowing users to convey information and RSS feeds from the last mentioned message boards and blogs within the OPSIS system.
- A *multi-tier search engine* so that end-users are able to search relevant public information throughout the entire web interactive system, within specific portlets such as Wikis, Message Boards, other Web 2.0 aware technologies and even in external integrated applications through its advanced multiple interfacing module.
- Intuitive *front end user interfaces* that share a set of common characteristics to promote user friendliness and accessibility. These are multilingual, in order for users to easily toggle between different language settings.
- *Web publishing tools* so to easily create and manage content, from a simple article of text and images to fully functional web sources.

In OPSIS, the JCR-compliant Alfresco [13] content infrastructure and content management enterprise system, based on known and used standards worldwide, has been properly integrated and configured for the public sector.

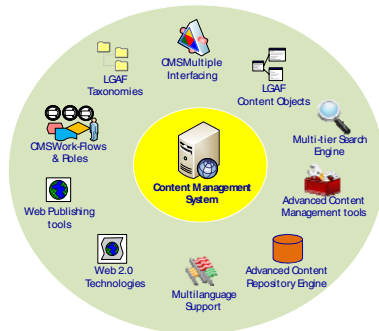


Fig. 2. OPSIS Content Management System Overview

4.2 OPSIS Decision Support System

Through the development of the OPSIS tool, extensive research was conducted in order to design appropriate decision reaching algorithms and patterns for embedding them into the core platform. The end-users of this system are entities acting as consultants for governmental policy makers, governmental organizations themselves and immigrants' bodies. The system is able to gather and present: An inventory of all current information assets (including legacy and relational data sources); Comparative figures such as tables, graphical representations and charts; Projected figures and proposed alternative future solutions based on hypothetical assumptions or the potential for convergence to best and common practices; The consequences of different decision alternatives, given past experience in a context that is described.

The OPSIS DSS allows the decision makers (or their advisors) to modify, complete, or refine the decision suggestions provided by the system, before sending them back to the system for validation. Afterwards the system improves, completes, and refines the suggestions of the decision maker and sends them back to them for validation. The whole process then starts again, until a consolidated solution is generated.

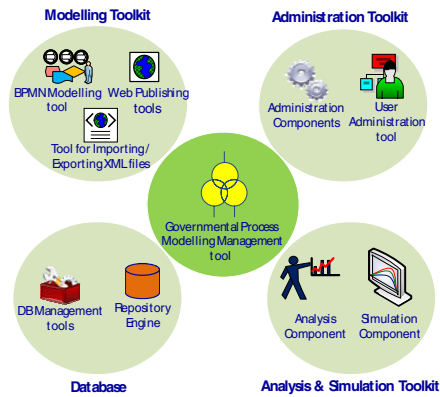


Fig. 3. OPSIS GPMM Overview

Part of the DSS suite of tools is the *Governmental Process Modelling Management (GPMM)* tool as depicted in the above figure, which enables experts to design and model complex workflows together in a graphical environment. The GPMM is a dedicated tool for the information acquisition, modelling and design, analysis, simulation, and evaluation of migration procedures and information items. The tool is envisioned to focus on usability, openness, method flexibility (customizability), and model maintainability.

The GPMM tool is designed to support non-technical users such as business analysts, process owners, and process managers, as well as more technically skilled information systems and enterprise architects interested in business processes and business process-related information such as documents, resources, systems, applications, and organizations. It enables the design of the migration-based workflows and governmental processes and consists of four main layers: *The Modelling Toolkit*, which models all

migration-based process in order to organize their embedded logic; *The Analysis and Simulation Toolkit*, which allows the investigation of impacts and effects of operation and changes in migration-based process and organisational structures; *The Administration Toolkit*, which manages several configuration settings of the operation environment in which the migration-aware services operate; *The Database*, which stores all the implemented processes and their current status.

4.3 OPSIS Web-Portal

The OPSIS Web Portal provides electronic based point of secure access to OPSIS services, information and content, retrieved and processed from diverse sources, in a unified and user-friendly way. As every synchronous web interactive system, it integrates complex mechanisms and operations, which are transparent to all end users. Automated processing is linked to the operational costs of the migration-aware services for the operating organizations, which satisfy a great number of requests with the need of only a handful of personnel under normal operations. In OPSIS this is leveraged by integrating peak technologies, which give to end-users the opportunity to perform part of processes by themselves.

The use of strong, open source frameworks and rich *User Interface (UI)* technologies such as *Spring Web Flow - SWF*, *Java Server Faces – JSF*, *AjaxAjsf*, *RichFaces* and *Facelets* [22], provide a user friendly web component based architecture, improving system performance. Moreover, they offer OPSIS the opportunity to easily build interactive interfaces with basic form controls and efficient, reusable operations, while future architecture developers will be able to separate the presentation logic from the UI component's business logic.

5 Conclusions-Future Research Directions

Migration policy making and monitoring as a process includes several steps: identification of the current internal policy situation, education and research on existing practices performed in other countries, comparison of processes and documents and heavy decision making and future planning. Also, the increased number of decision makers and stake holders involved in migration policies, increasing and diverged legislations and implemented migration procedures, different organizational structures, large and inhomogeneous legacy systems involved, cause a “chaos” in the monitoring of national policies and the harmonisation of procedures, processes and data formats. Migration Information systems need to be simple, open, reconfigurable and scalable. OPSIS is designed to support all these requirements in order to become a valuable asset and tool to policy makers in their everyday activities.

Integrating and properly orchestrating a number of advanced technologies and open-source software components, OPSIS constitutes an innovative revolutionary Migration Information System, able to strengthen operational pan-European cooperation in fight against illegal immigration and the harmonisation of policies.

Future work in this area involves the enhancement and further development of the OPSIS tool in order to explore its full potential as a holistic open collaborative and interactive system. The idea is to enable all migration related communities and societal groups to participate, express opinions and contribute in the migration policy processes

using an open, trustful and widely accessible environment. Sophisticated research and detailed analyses will also focus on the implementation and adoption of a properly customised identity management system.

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