SEEMP: A marketplace for the Labour Market

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Abstract: Employment Services are an important topic in the agenda of local governments and in the EU due to their social implications, such as sustainability, workforce mobility, workers' re-qualification paths, training for fresh graduates and students. Many administrations started their own E-Government projects whose imitations emerge as the demand of workers mobility increases. The SEEMP system presented in this paper overcomes this issue in different ways: starting bilateral communications with near-border similar offices, building a federation of the local employment services, and merging isolate trials. The SEEMP approach relies on a distributed semantic service oriented infrastructure able to federate local projects, in order to create geographically aggregated services for employment by leveraging existing local ones. The social and technical aspects of the SEEMP project are presented, showing how the SEEMP system is integrated with National level systems.

1. Introduction

Highly skilled human resources are becoming more and more the key factor in economic growth and competitiveness in the information age and in the knowledge economy. However, these resources are not yet effectively exchanged and deployed, despite the enlargement of the EU, mainly due to a still fragmented employment market built out of several fragmented and poorly communicating players.

The Single European Employment MarketPlace (SEEMP) Project brings a technical, organizational, and business response to this problem, by enabling a federated marketplace of employment mediation agencies, namely the Employment Mediation Marketplace (EMM) through a peer-to-peer network based on interoperation of employment data and mediation services (the complete list of participating SEEMP partners is available at http://www.seemp.org and, in Poland, at http://www.warszawa.mazowsze.pl).

The marketing strategy of the SEEMP-enabled employment marketplace recognises the following essential needs of the public employment administrations and private employment agencies:

- The provision of citizen-centred services of employment promotion and regulation;
- The market access to a large pool of human resources to maximise economic returns of staffing business.

SEEMP focuses on the *Job Seekers,* as central resources to bring the two key players of the job market into the SEEMP marketplace of employment mediation for high visibility of Job Seekers and Employers, and for effective matching between *Job Offers* from Employers and job requests, named from now on *Curricula Vitae* (*CV*), of citizens. The key business partnership among the public and private employment mediators facilitates the transparency and flow of information and can ultimately create significant social, as well as economic, impact. In fact the Job Seeker will be able to better achieve his/her personal, financial and career goals, and the Employer will be able to engage better talents to improve its economic performance and competitiveness.

The SEEMP adoption has been studied according to the SWOT analysis in terms of migration strategies, cost and performance expectations, and of job offer and search modes. The resulting considerations are that the SEEMP concepts and technologies will strengthen the social organisations and the public employment administration positions, will maximise the business turnover of the private employment agency, will support the citizens' productivity and their welfare, and will improve the competitiveness and performance of the employing businesses.

The purpose of this paper is to illustrate the SEEMP solution for an enabled marketplace of employment mediators, detailing the business objectives and the main features of the SEEMP technological platform. The purpose of SEEMP is to favour the meeting between Job Offers from Employers and CV of Job Seekers by developing an e-marketplace, improving the business activity of brokers in an employment market currently characterised by:

- *Multiplicity of the players on the market and diversity of the distribution networks*: Job Seekers and CV are distributed across many online databases, and brokers and intermediaries. In order to be sufficiently visible, a candidate or an enterprise has to contact several intermediaries (temporary work agencies, employment websites, …), with a redundancy of information and multiplication of the effort needed to correctly classify, qualify, and maintain the data.
- *Lack of common standard for Job Offer and CV*: The lack of standardised descriptions and search criteria shared by the intermediaries prevents them to exchange information easily and effectively.
- *Insufficient information sharing among the players on the labour market:* In spite of various existing information systems for e-employment, data sharing among entities of intermediary networks remains insufficient. The same holds for the cooperation aspects among players on the market, which need cooperative information systems technology.

The paper is organized as follows. In Section 2, we state the overall objectives of the SEEMP project. In Section 3, we present the methodologies adopted in SEEMP that encompass both business and technological aspects. In Section 4, the SEEMP technical solution is described. In Section 5, we illustrate the main achievements obtained in terms of services, and compare SEEMP with EURES and other job boards and employment search engines. In Section 6, we give concluding remarks and set the stage for evaluating SEEMP future directions.

2. SEEMP Objectives: Employment Market Vision

Although the e-recruitment market is growing worldwide, e-recruitment has developed quickest in Countries and Regions boasting both significant labour markets and a high coverage of Internet access. Hence, the greatest variety of online job exchanges and HR-websites can be found in Europe and North America.

A survey conducted in United Kingdom [1] shows that 20% of the online job seekers do not reside in the UK. Additionally, when comparing this survey with previous one made by the same organisation [2] it becomes evident that the number of foreign job seekers is constantly increasing. According to Forrester Research, the volume of the e-recruitment-market in the United States alone amounts to four billion US-dollars. Forrester Research estimates the potential of the European market to be significantly higher and was numbered at eight billion euros for 2003. Speculators expect explosive growth in this sector due to three macroeconomics trends, being shorter employment tenures, shrinking labour pools and need for hi-tech workers.

The e-recruitment industry remains highly fragmented and is continually evolving. In order to improve market transparency, several public bodies, like the German Federal Employment Office (BA- www.arbeitsagentur.de), the Swedish National Labour Market Administration (AMS- www.ams.se), the Public Employment Agency of Wallonia Belgium (www.leforem.be), and Regione Lombardia, Italy (www.borsalavorolombardia.net) [3], have started projects to create a federation of interoperable systems. In all projects, participating actors use terms from a controlled vocabulary to categorize their postings and send them to the central database using variations of the HR-XML data format. The collected postings are published through a central portal and are forwarded to commercially run job portals. The problem with these projects is that the whole market depends on a federation of databases, an approach to which many market participants object.
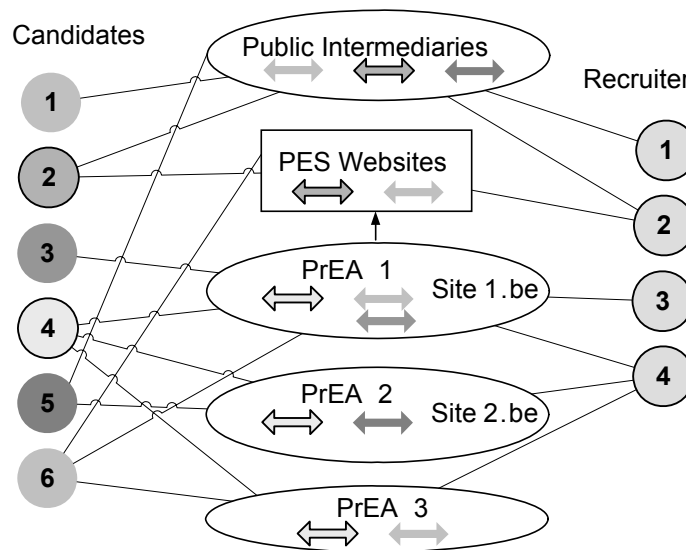

Figure 1: Sample matching between 6 candidates (looking for a job) and
4 recruiters (looking for suitable candidates)

Through SEEMP, the different National systems are planned to be interconnected into a marketplace as in Figure 1, where mediated access to the employment marketplace is shown for 6 Job Seekers (candidates), and 4 Employers (recruiters). Candidates and recruiters can decide to access both public and private intermediaries, that is, PESs and PrEAs. In the paper, we will use ES for Employment Systems in general, PES for Public systems and PrEAs for Private agencies, when the need to distinguish arises.

To ensure a wide visibility, candidates can subscribe to several different employment systems. Analogously, recruiters can exploit multiple public and private centres, in order to become visible in various different databases. These issues create problems when analysing the global number of Job Offers and CV, since the duplications alter the true market numbers. Moreover, the fragmented market of Job Offers and CV, due to the existence of isolated hosts of data, can prevent the candidates from seeing all the available Job Offers and, vice versa, the Employers to see all the available Job Seekers.

Centralising the information about all the Seekers and Employers to defrag the employment information market is not a feasible solution, since market rules and policies allow in all Countries to publish CV or Job Offers as many times as desired, through different operators (both public and private) and agencies. The solution adopted in SEEMP is *a cooperative environment* of nodes, namely a federated network of operators forming an e-marketplace where information is shared and traded upon the existence of independent but cooperating fragments. On this e-marketplace, *services*, such as job matching, are shared and data, such as CV, are exchanged under privacy rules, under business rules (e.g., with the consensus of the participants under the subsidiary principles), and using standard *service* and *data* formats (XML and extensions of WSDL). The SEEMP model of competition, named *coopetition*, created among multiple players is becoming a pressing need, both in the public and private world of employment operators, within and across Countries. In the EU context, coopetition can be a strong support to motivate organisations to be integrated into a European network.

3. SEEMP Methodology

SEEMP adopts a mix of methodologies that encompasses business and technological aspects. In order to analyse the **business aspects**, SEEMP partners have identified the potential target customers (*Employment Service Consumers*) focusing on their key needs. These consumers are:

- Public Employment Administrations (Local/National Governments, UE)
- Private Employment Agencies
- Education and training providers
- Job Seekers
- Employers
- Training Advisors and Job Counsellors.

Through an extended access to the job market services and information, *Employment Service Consumers* will benefit effective services and data in terms of citizen-centred government services and efficient employment market in spite of geographical, organisational, linguistic and systemic barriers.

For Private Employment Agencies, the business guidelines are not only centred around the issue of "having the Employer" but also around the access to a considerable repertoire of Job Seekers and their *CV*.

The SEEMP marketplace in this light is a market of *mediators* (see Figure 1) based on a large pool of human resources in the form of their *CV*. The beneficiaries are also the Job Seekers and Employers in personal, economic, and social senses. Moreover, the federation enables the adhering actors to maintain their operative and organizational autonomy, while extensively exchanging *CV* and Job Offers in a standard format, and preserving private business and local employment policies.

Regarding the **technological aspects**, SEEMP follows well established methodologies in the area of Software, Knowledge Engineering, and Information Systems, under the European Interoperability Framework (EIF) [4]. As illustrated above, the business aspects highlight the need for a system able to cover the whole EU and subsume hundreds of real

heterogeneous systems existing in EU Countries and Regions. It implies solving core issues like:

- *Language heterogeneity*, e.g., an Italian Java Analyst Programmer may be looking for Job Offers written in different European languages;
- *CV and Job Offers structural heterogeneity*, i.e., the use of standards like HR-XML (http://www.hr-xml.org) is not wide spread and a multitude of local formats exists;
- *CV and Job Offers content description heterogeneity*, i.e., European level occupation classifications like ISCO-88 (http://www.warwick.ac.uk/ier/isco/isco88.html) exist, but they do not reflect legitimate differences and perspectives of political economic, cultural and legal environments;
- *System heterogeneity in terms of service interface and behaviour*, i.e., no standard exists for e-employment services; thus, each ES implements them differently.

EIF does not prescribe any specific solutions, but rather recommends the principles for any e-Government service to be set up at a pan-European level: accessibility, multilingualism, security, privacy, use of open standards and of open source software (whenever feasible) and, last but not least, use of multilateral solutions.

SEEMP is proposed as an implementation of EIF relying on the concepts of services and semantics, as illustrated in the following.

1. SEEMPS relies on the concept of Service. Following the EIF, each PES and PrEA must expose its Business Interfaces in terms of Web Services. SEEMP models a unique consistent set of Web Services out of those exposed by the PESs and PrEAs. Therefore the services exposed by SEEMP become the actual standard for the distributed independent service providers. SEEMP uses *Mélusine* [5] as a tool for modelling abstract services and orchestrating the process of delegating the execution to distributed independent service providers.

2. SEEMPS relies on the concept of Semantics (both ontologies and mediators). For services, each local PES and PrEA has its own local ontology, used to describe at a semantic level the exposed Web Services and the structure/content of the exchanged messages. All these ontologies differ but share a common knowledge set about the employment domain. SEEMP models a unique consistent ontology, called the *reference ontology*, out of those exposed by the PESs and PrEAs. Therefore, the SEEMP reference ontology becomes the actual standard for the PESs and PrEAs, which should provide the mediators with methods for mapping the local ontologies into the reference one, and vice versa. SEEMP adopts *WSMO* [6], as a way to semantically describe Web Services, ontologies and mediators, and *WSML* [7], as a concrete syntax for encoding those descriptions. *Methontology* [8] is employed as a methodology for developing and maintaining these semantic descriptions.

A key point in the SEEMP methodology is a **minimal shared commitment,** in order to keep a "win-win" situation among all PESs and PrEAs. The commitment (both at services and semantics level) of each actor is kept minimal, in that PESs and PrEAs need to share services and data at the level needed to perform Job Offer/CV matching and other pre-agreed upon functions (such as, statistical computations on the employment market trends), while maintaining all the disagreements considered as necessary (e.g, CV are shared but kept anonymous until a Job Seeker manifests an interest in contacting the Job Seeker, e.g. through a mediator).

4. Technology Description

The technical solution in SEEMP is composed (see Figure 2) of *a Reference level* which reflects the minimal shared commitment in terms of services and semantics, and by *the Connectors* toward the various local actors.
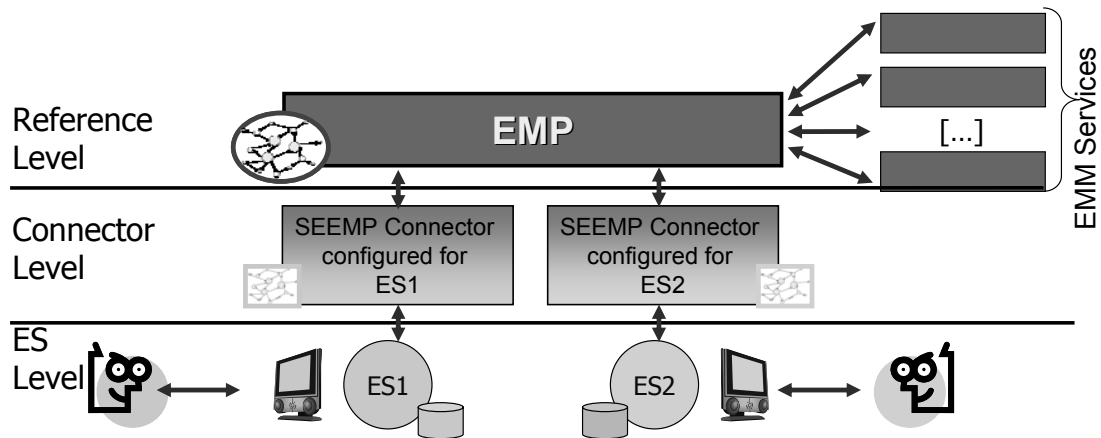
Figure 2: A bird view of SEEMP technical solution

The Reference level is composed of a central element, named *EMP (Employment Marketplace Platform)* and of a set of services provided to the marketplace, named the EMM (Employment Marketplace Mediators) Services.

EMP offers abstract services that are made *concrete by delegation*: when the abstract service is invoked, the EMP delegates its execution to the appropriate ESs by invoking the correspondent concrete services. It acts as a multilateral solution, as request by EIF, in which all the services connected to the EMP are made available to all other ESs.

The **EMM Services** support the EMP in the execution of operations through the marketplace. The running example of Figure 1 requires two basic SEEMP services: *discovery* and *ranking*. The *discovery* service is offered by Glue Discovery Engine [9]. The EMP invokes Glue before delegating the execution to the concrete services exposed by the ESs. Glue analyzes the available CV and selects the ESs that are more likely to return relevant Job Offers. The *ranking* service is used to merge and classify the results, by providing a homogeneous ranking function (e.g., in terms of relevance of contained terms) of the returned Job Offers. EMM services rely on the fact that local ES expose also information regarding the *quality* of the provided services and data. According to such quality information, users can shape their requests, either of Job Offers or of CV, to include also preference parameters that make their search wishes explicit. In such a way, they can drive the discovery service to select only those services that satisfy given quality of service and data quality requirements, and the ranking service to return personalized lists of answers, based on a weighted evaluation of the considered properties.

The components of the Reference level rely on a vocabulary defined in the **Reference Ontology**, acting as a common language, or *interlingua,* in the form of a set of controlled vocabularies to describe the details of Job Offers and CV. The Reference Ontology must represent a common agreement among the ESs involved in SEEMP; hence, its specification is based on international *standards*, such as NACE, ISCO-88 (COM), FOET, etc., and international *codes*, such as ISO 3166, ISO 6392, etc.. Basically, the Reference Ontology is composed of 13 sub-ontologies: *Competence, Compensation*, *Driving License*, *Economic Activity*, *Education*, *Geography*, *Job Offer*, *Job Seeker*, *Labour Regulatory*, *Language*, *Occupation*, *Skill* and *Time*. The main sub-ontologies are the *Job Offer* and *Job Seeker*, which are intended to represent the structure of Job Offers and CV respectively, built upon some HR-XML recommendations. Other SEEMP sub-ontologies have been derived from the international standards and ES classifications that are considered to best fit the European requirements.

The SEEMP Connectors enable all communications between the EMP and a given ES. A SEEMP Connector will exist for each participant of the marketplace and has two main responsibilities:

- *Lifting and Lowering*: when communicating with the ES, any outgoing (or incoming) data exchanged by means of Web Services must be lifted form XML to WSML in terms of the local ontologies of the ES (or lowered back to the XML level from WSML).
- *Resolving Heterogeneity*: each ES has its own local ontology representing its view on the employment domain. The SEEMP Connector is properly configured with semantic mappings able to solve these heterogeneity issues, by converting all the ontologized contents (the contents lifted from the XML received from the ES) into contents in terms of the reference ontology, and vice versa.

These two tasks are achieved by means of: i) an extension to the R_2O language [10], enabling to describe mappings between XML schemas and ontologies; ii) an extension to the *ODEMapster* processor [11] and iii) the use of *WSMX data mediation* [12] to transforming data between the local and reference ontologies.

The decision of two steps in the process of taking syntactic data from each ES and making them available at the EMP level homogenously was reached based on the complexity of this transformation. By first lifting the syntactic data to a semantic format similar to its structure (a relatively easy task), the complexity is moved to the second step, where semantics is already present and where simple logical rules can be applied to solve complex heterogeneities between the local and reference ontological representations. Of course, when the ES data are already semantically close to the reference ontology, the second step can be skipped. Ongoing research is looking at the types of SEEMP connectors needed for ESs positioned at different technological advancement levels.

5. Main Results and Business Benefits

Table 1 summaries the functional features of a marketplace based on the SEEMP platform. It compares with EURES (http://europa.eu.int/eures), Job boards (Monster - http://www.monster.com, Stepstone - http://www.stepstone.com), and employment search engines such as Keljob (http://www.keljob.com/) and thematic platforms.

Table 1: Comparison between SEEMP and other technical solutions

	EURES	Job boards Employment Search Engine	Thematic Platform	SEEMP
Target	Final User (B2C)	Final Client (B2C)	End user in specific niches (B2C)	Employment agencies (public + private)
Users	Candidates Companies Brokers PES	Candidates Companies Brokers	Candidates Companies Brokers	IT administrators of Employment agencies (public + private)
Access given to Jobseekers	Direct on the centralised platform	Direct	Restricted to members	Visibility given to jobseekers only through their usual employment websites (PES or other employment agency)
Access given to Employers	Visibility given to vacancies only through Public employment agency + use of web services	Direct	Restricted to members	Visibility given to vacancies only through all types of employment agency members of SEEMP +use of web services
Company supporting the activity	National Public institution only	Commercial companies only	Commercial companies only	National + Regional + local Public and private institutions

6. Conclusions and Future Work

This paper has presented the main issues of the SEEMP marketplace of mediators for e-employment where public and private market mediators (PESs and PrEAs) can collaborate and complement in a "coopetitive" model. Final beneficiaries of their "win-win" situation are Job Seekers and Employers, with significant potential social and economic impact. Currently, the SEEMP consortium is running a pilot that shows the integration of EURES and Borsa Lavoro Lombardia, according to user requirements stated in [13-15]. The next step is to integrate Le FOREM PES as a validation case, in order to test the impact level of adding a new node to the marketplace.

Future work includes extending the number of abstract services in the EMPAM and the respective concepts in the reference and local ontologies. For instance, one essential service of SEEMP should be the possibility to produce on a regular basis (e.g., monthly, weekly, daily, …) a set of key indicators regarding the labour market in all participant Regions (job seekers, job offers, training opportunities, most requested job/skills, etc.), in a common and comparable language, both in terms of methods (definitions, calculation of indicators, etc.) and in terms of technical requirements.

Acknowledgements

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